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# U.S. Army Center for Health Promotion and Preventive Medicine

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## TRAINING MUNITIONS HEALTH RISK ASSESSMENT

NO. 39-EJ-1485-00

RESIDENTIAL EXPOSURE FROM INHALATION OF  
AIR EMISSIONS FROM THE

M918 40-MM PRACTICE CARTRIDGE OR THE

M781 40-MM PRACTICE CARTRIDGE

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Readiness Thru Health

## *U.S. Army Center for Health Promotion and Preventive Medicine*

*The lineage of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) can be traced back over 50 years. This organization began as the U.S. Army Industrial Hygiene Laboratory, established during the industrial buildup for World War II, under the direct supervision of the Army Surgeon General. Its original location was at the Johns Hopkins School of Hygiene and Public Health. Its mission was to conduct occupational health surveys and investigations within the Department of Defense's (DOD's) industrial production base. It was staffed with three personnel and had a limited annual operating budget of three thousand dollars.*

*Most recently, it became internationally known as the U.S. Army Environmental Hygiene Agency (AEHA). Its mission expanded to support worldwide preventive medicine programs of the Army, DOD, and other Federal agencies as directed by the Army Medical Command or the Office of The Surgeon General, through consultations, support services, investigations, on-site visits, and training.*

*On 1 August 1994, AEHA was redesignated the U.S. Army Center for Health Promotion and Preventive Medicine with a provisional status and a commanding general officer. On 1 October 1995, the nonprovisional status was approved with a mission of providing preventive medicine and health promotion leadership, direction, and services for America's Army.*

*The organization's quest has always been one of excellence and the provision of quality service. Today, its goal is to be an established world-class center of excellence for achieving and maintaining a fit, healthy, and ready force. To achieve that end, the CHPPM holds firmly to its values which are steeped in rich military heritage:*

- ★ Integrity is the foundation
- ★ Excellence is the standard
  - ★ Customer satisfaction is the focus
  - ★ Its people are the most valued resource
    - ★ Continuous quality improvement is the pathway

*This organization stands on the threshold of even greater challenges and responsibilities. It has been reorganized and reengineered to support the Army of the future. The CHPPM now has three direct support activities located in Fort Meade, Maryland; Fort McPherson, Georgia; and Fitzsimons Army Medical Center, Aurora, Colorado; to provide responsive regional health promotion and preventive medicine support across the U.S. There are also two CHPPM overseas commands in Landstuhl, Germany and Camp Zama, Japan who contribute to the success of CHPPM's increasing global mission. As CHPPM moves into the 21st Century, new programs relating to fitness, health promotion, wellness, and disease surveillance are being added. As always, CHPPM stands firm in its commitment to Army readiness. It is an organization proud of its fine history, yet equally excited about its challenging future.*

## REPORT DOCUMENTATION PAGE

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REPLY TO  
ATTENTION OF

MCHB-TS-EHR

TRAINING MUNITIONS HEALTH RISK ASSESSMENT NO. 39-EJ-1485-00  
RESIDENTIAL EXPOSURE FROM INHALATION OF AIR EMISSIONS  
FROM THE M918 40-MM PRACTICE CARTRIDGE OR THE  
M781 40-MM PRACTICE CARTRIDGE

**EXECUTIVE SUMMARY**

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This assessment evaluated the potential for human health effects to offsite residents breathing air emissions following use of the M918 40-mm Practice Cartridge (M918) or the M781 40-mm Practice Cartridge (M781) during training exercises. The M918 and M781 were evaluated separately and the results of both analyses are presented in this report.

To conduct this assessment, air emissions from the M918 and the M781 were collected in a test chamber at the U.S. Army Aberdeen Test Center, Maryland. The data collected from the Firing Point Emission Study provided the amount and types of substances released from the M918 and the M781. This information was then used in an air dispersion model to determine ambient air concentrations at a location 100 meters (328 feet) downwind from a site where the M918 or the M781 may be used. Since the training facility in this assessment is hypothetical, the air model used assumptions that provided conservative estimates of air concentrations.

Modeled air concentrations were combined with exposure information (e.g., number of cartridges used per year) to estimate the amount of each substance the hypothetical offsite resident breathes. This estimate was then compared with the substance's health information, which was obtained from agencies such as the U.S. Environmental Protection Agency, to determine if there is a potential for health risks from inhalation.

The health risk assessment included both long-term (30 years) and short-term (15-minute or 1-hour) exposures to modeled substance concentrations. Assessment results, generated using conservative methods, showed that the hypothetical offsite resident breathing air as close as 100 meters from either the M918 or the M781 firing locations, is safe from these emissions. It should be noted that at most training installations, training areas are over 1,000 meters (over half a mile) away from populated areas.

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## **LIST OF ACRONYMS**

AEC	U.S. Army Environmental Center
AEGL	Acute Exposure Guideline Levels
AIHA	American Industrial Hygiene Association
ATC	U.S. Army Aberdeen Test Center
ATV	Acute Toxicity Value
DODIC	Department of Defense Identification Code
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guidelines
HBSL	Health-Based Screening Level
HCI	Hydrogen Chloride
INPUFF	Integrated PUFF Model
NAAQS	National Ambient Air Quality Standards
NEW	Net Explosive Weight
OEL	Occupational Exposure Limit
PM <sub>10</sub>	Particulate Matter under 10 microns in size
PRG	Preliminary Remediation Goals
RBC	Risk-Based Concentration
RfC	Reference Concentration
TEEL	Temporary Emergency Exposure Limits
TPH	Total Petroleum Hydrocarbons
TSP	Total Suspended Particulates
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine

TRAINING MUNITIONS HEALTH RISK ASSESSMENT NO. 39-EJ-1485-00  
RESIDENTIAL EXPOSURE FROM INHALATION OF AIR EMISSIONS FROM THE  
M918 40-MM PRACTICE CARTRIDGE OR THE M781 40-MM PRACTICE  
CARTRIDGE

1. PURPOSE

This document presents the assessment of the potential for human health effects to offsite residents breathing air emissions following use of the M918 40-mm Practice Cartridge (M918) or the M781 40-mm Practice Cartridge (M781) during training exercises. The M918 and M781 were evaluated separately and the results of both analyses are presented in this report.

2. AUTHORITY

Memorandum, U.S. Army Environmental Center, 4 June 1999, Subject: Pyrotechnics Risk Assessment.

3. REFERENCES

See Appendix A for a list of references.

4. BACKGROUND

4.1 CARTRIDGES AND THEIR USE

Cartridges are cases that contain a primer, propelling charge, and projectile. The primer is needed to activate the propelling charge, which provides the force to send the projectile to a target. Examples of projectiles include bullets, rockets, and missiles. Cartridges are also referred to as "rounds" and are fired from weapons such as pistols or rifles.

4.2 WHAT ARE THE M918 AND THE M781?

The M918 is a practice cartridge used only in training. It mimics the appearance and behavior of the M430 cartridge used in combat (Reference 1). The M918 can be identified by its blue and brown color with black markings.

The M781 is a practice cartridge that is fired from a 40-mm Grenade Launcher, M203. It can be identified by its blue casing with white marking (Reference 1). Both the M918 and M781 are about the length of a soda can.

4.3 USE OF THE M918 AND THE M781

The M918 is most commonly used with the 40-mm Grenade Machine Gun (Mark 19). Multiple cartridges are linked together and fired consecutively at targets at varying

distances. The M918 can reach a target up to 2,200 meters (1.4 miles) away (Reference 2).

The M781 is used during practice to train soldiers to use the M203. The M203 is like a sliding barrel that is attached to the M16 series rifle. When launched, the M781 can reach a maximum distance of up to 400 meters (0.25 miles) away. Upon impact, the M781 releases a bright yellow-orange smoke that can be used to determine the distance from the target (Reference 3).

#### 4.4 ASSESSMENT SUMMARY

The M918 and the M781 were evaluated separately using the same approach. This approach consisted of two main parts: air dispersion modeling and exposure assessment, which are briefly discussed in the paragraphs below. Sections 5 through 7 present a discussion of the methodology used for this assessment.

Emissions data used in the air dispersion modeling were obtained from the Firing Point Emission Study, conducted by the U.S. Army Aberdeen Test Center (ATC), at Aberdeen Proving Ground, Maryland (Reference 4). This study was funded by the U.S. Army Environmental Center (AEC) with the purpose of identifying and quantifying emissions from weapons firing. Data from this study were generated by firing munitions in a test chamber using weapons that are representative of those used by the U.S. Army during training operations. Emissions data for the M918 and M781 were generated by firing them from the Mark 19 machine gun and the M203 40-mm Grenade Launcher, respectively.

The emissions data for the M918 and M781 were used with an atmospheric dispersion model to estimate the average concentrations that might be experienced by an offsite resident. Since this assessment is designed to provide results that would be applicable to most Army training facilities, the training area used in this assessment was a hypothetical one. While most training areas are at least 1,000 meters away from populated areas, as a conservative distance, it was assumed that a person could reside 100 meters downwind from the firing point (location where the weapon is positioned). In addition, air-modeling parameters were selected to mimic worst-case conditions.

The exposure assessment included calculations of time-averaged concentrations for both long-term (chronic) and short-term (acute) exposures. For the purpose of this assessment, air concentrations were averaged over 30 years for chronic exposures and 1-hour or 15 minutes for acute exposures. Using a screening approach, a substance's estimated time-averaged concentration was then compared to chronic health-based screening levels (HBSLs) established by the U.S. Environmental Protection Agency (EPA) or acute toxicity values (ATVs) established by selected agencies depending on the exposure duration (i.e., 30 years versus 1-hour or 15 minutes). The comparison was made using the ratio of the HBSL or ATV to the estimated air concentration for each of the substances evaluated. If this ratio was less than one, no further evaluation was needed. This approach is conservative because the exposure assumptions used by the agencies, to establish HBSLs and ATVs, are likely to overestimate the exposures experienced by offsite residents living near firing ranges. If the chronic or acute

averaged concentrations ( $C_{\text{chronic}}$  and  $C_{\text{acute}}$ ) were greater than these screening levels, further analysis would be warranted to determine the potential for health effects. Note that concentrations greater than the screening levels do not indicate an onset of health effects, but rather the potential for such.

## 5. DATA COLLECTION AND AIR MODELING

### 5.1 EMISSION FACTORS

Emission factors, used to derive the air modeling emission rates used in this assessment, were generated from the Firing Point Emission Study conducted by the ATC (Reference 4). The data included the net explosive weight (NEW) of the item, the substances sampled, and substance-specific emission factors. Emissions data from the Firing Point Emission Study are included in the first four columns of the table located in Appendix B.

### 5.2 BACKGROUND AND DESCRIPTION

Air dispersion models are available to mathematically simulate plume behavior and to estimate downwind concentrations of substances emitted from various sources. However, specific models are not available to determine the dispersion of emissions from munitions used during training. Estimating the magnitude and location of these concentrations depends on many factors including the amount and type of emissions, the behavior of the source, and meteorological conditions. Since a specific model is not available for modeling the use of munitions during training, the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) evaluated numerous air models to determine which would be suitable for use with munitions used during training. The USACHPPM recommended using the Integrated PUFF (INPUFF) model to estimate the dispersion of emissions from various munitions sources (Reference 5).

The INPUFF model (Reference 6) was developed to simulate dispersion from instantaneous or semi-continuous point sources. This Gaussian-integrated puff model is capable of addressing a cloud type release over short periods of time, and computations can be performed for a single point source for multiple receptors. The algorithms used to calculate concentrations assume a vertically uniformed wind direction (with no chemical reaction) to compute the contribution of each cloud at a receptor for each time step/interval.

### 5.3 MODEL ASSUMPTIONS

Some assumptions were made to best represent the firing of the M918 and M781 cartridges. These assumptions were as follows:

- Typically, with conventional point sources, the cloud rise and formation are determined by characterizing flue gas exit velocity, temperature, and stack diameter. However, the 40-mm cartridges are used in conjunction with the Mark 19 and the M203 guns. For unconventional sources with no real physical stack dimensions, such as the Mark 19 and the M203, the stack

height and diameter were determined to be equal to the height of the barrel and the bore diameter. No exit velocity was used with these sources because the emission rates generated from the test data were obtained from sampling a stabilized cloud with no exit velocity. Table 1 includes the source parameters used to model the M918 and the M781 cartridges.

TABLE 1: SOURCE PARAMETERS

Parameter	40 -mm Practice Cartridges	
	M918	M781
Source/Stack Diameter	0.040 meters	0.040 meters
Source/Stack Height	1 meter	1 meter
Source Exit Temperature	293 degrees Kelvin ( $^{\circ}$ K) (or 68 $^{\circ}$ F)	
Exit Velocity	0 meters/second	0 meters/second
Initial horizontal dispersion coefficient ( $\sigma_y$ )	2.29 meters	0.96 meters
Initial vertical dispersion coefficient ( $\sigma_z$ )	1.07 meters	1.07 meters

- Initial cloud dimensions are preferred to model the air emissions from these types of releases. This information was not measured during the Firing Point Emission Study; therefore, the cloud dimensions were based on the test chamber dimensions and the volume of air sampled. The cloud dimensions were used to define the initial horizontal and vertical dispersion values ( $\sigma_y$  and  $\sigma_z$ ) of the released cloud. The cloud exit temperature was assumed to be equal to the test chamber temperature. The cloud dimensions were calculated using the following equation:

$$h = \frac{V}{\pi r^2} \quad \text{Equation 1}$$

Where:

$h$  = length of the test chamber (ft)  
 $V$  = Volume of air sampled (ft<sup>3</sup>)  
 $r$  = inner radius of the test chamber (ft)

Note: The length of the test chamber was adjusted with removable interior partitions to accommodate the physical size of weapon tested and the quantity of emissions to be generated.

Example 1 provides a sample calculation for the clouds produced by the M781 used with the M203 gun.

**Example 1**

**Sample Calculation Using Equation 1:**

$$h = \frac{240}{\pi(3.5)^2} = 6.24 \text{ ft}$$

Note: Assuming an elliptical cloud with the prevailing wind direction being perpendicular to the launcher muzzle when fired,  $r$  is equal to the initial vertical dispersion,  $\sigma_z$ , and the initial horizontal dispersion,  $\sigma_y$ , is equal to one half the length of the test chamber.

- For the purposes of this assessment, a hypothetical offsite resident was assumed to be located 100 meters directly downwind from the source. The meander of the cloud is a major factor when estimating concentrations at given locations downwind from the source. Assuming that the offsite resident is directly downwind from the source is the same as assuming that there is no cloud meander and the center of the cloud migrates directly over the hypothetical offsite resident. This assumption provides the most conservative modeled concentrations.
- Since this assessment does not look at a specific training site, generic, worst-case meteorological data were used. To determine the worst-case meteorological conditions that would result in the highest air emission concentrations, the modeling was performed using the EPA Risk Management Program Guidance (Reference 7). This guidance includes tables for estimating the footprint of chemical releases and is intended to inform emergency responders of potential accidental releases. The EPA has defined most default conditions for meteorological modeling parameters. Table 2 lists the meteorological parameters that were used in the air models for the M918 and the M781.

**TABLE 2: WORST-CASE METEOROLOGICAL PARAMETERS**

Parameter	Input Value
Wind Speed	1 meter/second
Atmospheric Stability	Category F
Wind Direction	270°
Ambient Temperature	293 degrees Kelvin (°K) (or 68 °F)

#### 5.4 GENERAL METHODOLOGY

The model was run for a total calculation time of 200 seconds (3.33 minutes) to simulate a single cartridge being fired and to ensure that the total mass of the cloud had passed the worst-case receptor location. Concentrations were calculated every 2

seconds. The model results indicated that the initial cloud reached the hypothetical offsite resident within 76 seconds and dissipated below the lowest concentration the model calculated, which in this instance ( $1 \times 10^{-11} \text{ g/m}^3$ ) occurred within 148 seconds. Table 3 contains the air model input parameters used in this assessment.

**TABLE 3: AIR MODEL INPUT PARAMETERS**

Parameter	Input Value
Number of meteorological periods (NTIME)	1
Duration of each meteorological period (ITIME)	200 seconds
Number of updates to the source (NSRCDS)	100
Duration/time step between each source update (ISUPDT)	2 seconds
Total time modeled/Simulation Period (NTIME)(ITIME)= (NSRCDS)(ISUPDT)	200 seconds

## 5.5 USE OF MODEL OUTPUT

The concentrations provided by the INPUFF model were based on a unit emission rate of 1 gram/second from an emission source and did not represent any substance-specific concentrations from the use of any weapons system. This unit emission rate is typically used for ease of modeling purposes. The relationship between the emission rate and predicted concentration is linear. Therefore, the ratio of the predicted concentration to the unit emission rate was multiplied by each substance-specific emission rate to provide substance-specific concentrations.

## 5.6 DETERMINATION OF SUBSTANCE-SPECIFIC EMISSION RATES

The actual substance emission rate for one item ( $ER_1$ ) for each substance was calculated using Equation 2. Example 2 contains a sample calculation using this equation.

$$ER_1 = \frac{EF \cdot CV}{t} \quad \text{Equation 2}$$

Where:

$ER_1$  = emission rate for one item (g/sec)

$EF$  = average adjusted emission factor (lb/item)

$CV$  = conversion factor (453.59 g/lb)

$t$  = release duration obtained from the INPUFF model (sec)

**Example 2**  
**Sample Calculation Using Equation 2:**

$$ER_1 = \frac{(2.522 \text{ E - 04})(453.59)}{(2)} \times 1 \text{ item}$$
$$= 5.721 \text{ E-02 g/sec}$$

Calculation provided for Carbon Dioxide (CO<sub>2</sub>) for the M781. Averaged adjusted emission factor of CO<sub>2</sub> in lb/cartridge was obtained from Appendix B.

Substance-specific ambient concentrations for one item (CONC) were calculated using the following equation. A sample calculation using this equation is provided in Example 3.

$$\text{CONC} = ER_1 \cdot \frac{UC}{ER_{unit}} \quad \text{Equation 3}$$

Where:

CONC = substance concentration based on one item (g/m<sup>3</sup>)

ER<sub>1</sub> = emission rate for one item (g/sec)

ER<sub>unit</sub> = unit emission rate as used in the model (g/sec)

UC = concentration based on the unit emission rate (g/m<sup>3</sup>)

**Example 3**  
**Sample Calculation Using Equation 3:**

$$\text{CONC} = (5.721E - 02) \frac{(2.030E - 04)}{(1)}$$
$$= 1.161E-05 \text{ g/m}^3$$

Calculation provided for CO<sub>2</sub> for the M781.

## 6. RISK ASSESSMENT

### 6.1 EXPOSURE ASSUMPTIONS

Exposure assumptions were selected using a typical use scenario for the M918 and the M781 during training exercises. The use of both types of 40-mm practice cartridges (M918 and M781) was evaluated separately in this assessment. The typical use scenario was provided by the AEC and is based on consultation with their senior training advisor (References 8, 9). The frequency of use for the M918 and M781 was required to determine how much substance an offsite resident would be exposed to in the time period of interest (i.e., acute or chronic exposure). Table 4 summarizes the general use scenario for the M918 and M781.

**TABLE 4: FREQUENCY OF USE FOR THE M918 AND THE M781**

Parameter	40-mm Practice Cartridges	
	M918	M781
Number of cartridges used per year	15,432	15,488
Maximum number of cartridges used in 1- hour	160	144

### 6.2 TIME-AVERAGING

For the chronic assessment, time-averaged concentrations were calculated using the EPA's default residential exposure duration of 30 years. This is consistent with the exposure duration used by the EPA, which assumes that the resident spends 30 years at the same residence. By using the same exposure duration, the estimated time-averaged concentrations were compared with the selected HBSLs, which were derived using standard EPA default assumptions.

Using the default residence time established by the EPA, the assumption was made that someone could be exposed to air emissions from 15,432 or 15,488 cartridges per year for 30 years for the M918 and the M781, respectively. Table 5 lists the exposure parameters used to estimate concentrations for the chronic assessment. These parameters are based on the typical use scenario provided by AEC (Table 4) and the assumptions used in the air model run.

**TABLE 5: EXPOSURE PARAMETERS USED TO DETERMINE TIME-AVERAGED CHRONIC AIR CONCENTRATIONS**

Exposure Parameter	Value Used	
	M918	M781
Exposure Time ( $ET_{ctg}$ )	3.333 min/cartridge <sup>1</sup>	3.333 min/cartridge <sup>1</sup>
Exposure Frequency ( $EF_{ctg}$ )	15,432 cartridges/year	15,488 cartridges/year
Exposure Duration (ED)	30 years <sup>2</sup>	30 years <sup>2</sup>

<sup>1</sup> Based on the total model time of 200 seconds (3.33 minutes) used in the air model run.  
<sup>2</sup>EPA default value.

Chronic averaged concentrations were calculated using Equation 4. Example 4 shows how this calculation was performed, using the total suspended particulates (TSP) concentration from the M781 as an example. The TSP is classified as a noncarcinogen, as indicated in Appendix C, the averaging time (AT) is the same as the exposure duration.

$$C_{chronic} = \frac{CONC \cdot 10^6 \cdot ET_{ctg} \cdot EF_{ctg} \cdot ED}{525,600 \cdot AT} \quad \text{Equation 4}$$

Where:

- $C_{chronic}$  = average chronic concentration ( $\mu\text{g}/\text{m}^3$ )
- CONC = average modeled concentration for one cartridge ( $\text{g}/\text{m}^3$ )
- $10^6$  = unit conversion ( $\mu\text{g}/\text{g}$ )
- $ET_{ctg}$  = exposure time per cartridge (minutes/cartridge)
- $EF_{ctg}$  = exposure frequency (cartridges/year)
- ED = exposure duration (years)
- 525,600 = unit conversion (minutes/year)
- AT = averaging time (years)  
(carcinogenic endpoint: AT = 70 years  
noncarcinogenic endpoint: AT = ED)

**Example 4  
Sample Calculation Using Equation 4:**

$$C_{\text{chronic(TSP)}} = \frac{(1.565E-06)(10^6)(3.333)(15,488)(30)}{(525,600)(30)}$$
$$= 1.54E-01 \mu\text{g/m}^3$$

The average modeled concentration for one cartridge (CONC) was obtained from Appendix B. The exposure parameters were obtained from Table 5.

Unlike the chronic assessment, only limited guidance for evaluating acute exposures is currently available. Since many cartridges may be fired in a short period of time, acute exposures cannot be overlooked. For the purpose of this assessment, acute exposure is defined as a 1-hour or 15-minute exposure. The 1-hour or 15-minute acute exposure averaging times allow for comparison with guidelines developed specifically for emergency planning purposes (refer to the discussion on acute toxicity below).

The exposure frequency is based on the number of cartridges used per 1-hour or 15 minutes depending on the guideline used for comparison. This information is based on the use scenario provided in Table 4. To estimate air concentrations for potential acute health effects, it was conservatively assumed that 160 M918s or 144 M781s are fired in 1- hour. The average acute concentrations were computed using Equation 5. Example 5 contains a sample calculation of this equation using the M918. Since TSP does not have an ATV, hydrogen chloride (HCl) is used as the example substance.

$$C_{\text{acute}} = \frac{\text{CONC} \cdot 10^6 \cdot ET_{\text{ctg}} \cdot EF_{\text{ctg}}}{60} \quad \text{Equation 5}$$

Where:

$C_{\text{acute}}$  = average acute concentration ( $\mu\text{g/m}^3$ )  
 $\text{CONC}$  = average modeled concentration for one cartridge ( $\text{g/m}^3$ )  
 $10^6$  = unit conversion ( $\mu\text{g/g}$ )  
 $ET_{\text{ctg}}$  = exposure time per cartridge (minutes/cartridge)  
 $EF_{\text{ctg}}$  = exposure frequency (cartridges/hour)\*  
60 = unit conversion (minutes/hour)

\* Based on 1- hour or 15 minute (0.25 hour) acute toxicity value

**Example 6**

**Sample Calculation Using Equation 6:**

$$C_{acute(HCl)} = \frac{(2.411E-08)(10^6)(3.333)(160)}{60}$$
$$= 2.14E-01 \mu\text{g}/\text{m}^3$$

The average modeled concentration for one cartridge (CONC) for HCl for the M918 was obtained from Appendix B. See Appendix C to determine the acute toxicity value used.

## 6.3 TOXICITY ASSESSMENT

The potential for health effects was determined by comparing time-averaged air concentrations to HBSLs and ATVs, which are developed from a substance's known toxicity. These toxicity values typically include different levels of safety factors depending on the level of confidence of the critical study. Appendix C contains a table of screening toxicity values used for the chronic and acute assessments.

### 6.3.1 CHRONIC ASSESSMENT

The chronic assessment was conducted using a screening approach. Using this method, a substance's estimated time-averaged air concentration was compared to its HBSL by using the ratio of the HBSL to the estimated concentration. If this ratio was less than one, no further analysis was needed. This approach is conservative because the exposure assumptions used by the EPA, to establish HBSLs, assume that the resident is exposed for 350 days per year (assuming 2 weeks vacation per year). In contrast, exposure to air emissions from actual training activities at a firing range is intermittent and is not likely to occur on a daily basis year round.

A hierarchy of sources was developed for selection of the HBSLs to quantitatively evaluate as many of the identified substances as possible. The hierarchy of sources used was as follows:

- Clean Air Act, EPA National Ambient Air Quality Standards (NAAQS) (Reference 13)
- EPA Region 9 Preliminary Remediation Goals (PRGs) (Reference 11)
- EPA Region 3 Risk-Based Concentrations (RBCs) (Reference 10)

Some substances have neither PRGs nor RBCs because they have their own set of regulatory standards. Under the Clean Air Act, the EPA is required to establish NAAQS for several substances considered harmful to public health and the environment. Currently, NAAQS are available for seven substances. The NAAQS for the longer averaging time were used for the chronic assessment. Depending on the substance, this can range from an 8-hour average to an annual average. In addition,

since the majority of the measured TSP was PM<sub>10</sub> (particulate matter under 10 microns in size) (Reference 4), the NAAQS for PM<sub>10</sub> was used to evaluate the potential for health effects from exposure to TSP.

Next on the hierarchy, after the NAAQS, are the EPA Region 9 PRGs and the EPA Region 3 RBCs. Since the methodology used by EPA Region 9 to develop the PRGs generally results in lower values than the EPA Region 3 RBCs, the PRGs were first on the hierarchy of sources. RBCs were used when a PRG was not available. The only exception was for chromium (VI) [Cr (VI)] where Region 9 used a carcinogenic toxicity value that was seven times greater than EPA's recommended value (Reference 12) to develop its screening level for inhalation exposure. Since the EPA does not advocate the application of this multiplication factor, the RBC for Cr (VI) was used instead of the PRG. To ensure that the most recent information was used, the Internet sites of both EPA Regions were checked. The HBSLs used for this assessment are presented in Appendix C.

Although the general approach used by both EPA Region 3 and Region 9 is the same, the exposure assumptions differ enough so that final recommended values can vary to a certain degree. In both methods, a substance's screening concentration was selected using the toxicity endpoint that derives a lower concentration. For example, if a substance has a known systemic toxicity and is a carcinogen, the screening concentration was calculated using both toxicity values. To maintain a conservative approach, EPA then selected the lower screening concentration as the recommended PRG or RBC.

Example 6 shows a sample calculation of how a substance's estimated chronic concentration was compared to its HBSL using the TSP concentration for the M781.

**Example 6**  
**Sample Calculation Comparing a Substance's Estimated Chronic Concentration to Its HBSL:**

$$\frac{C_{\text{chronic(TSP)}}}{HBSL} = \frac{1.54E - 01}{5.00E + 01}$$
$$= 3.08E - 03 < 1$$

In this case, the resulting ratio is less than one, indicating further evaluation is not necessary.

Many petroleum hydrocarbons were detected but do not have specific screening levels. Therefore, the approach recommended by the Total Petroleum Hydrocarbon Criteria Working Group (Reference 14) was adopted to evaluate petroleum hydrocarbon mixtures. Based on the working group's assessment of various hydrocarbons, it was recommended that mixtures be separated according to a

substance's number of carbons and its chemical class (i.e., aliphatic or aromatic<sup>1</sup>). Generally, as a substance's carbon number increases, its molecular weight increases, and it is, therefore, not a substance of concern via inhalation. The working group also concluded that aromatic hydrocarbons tend to be more toxic than aliphatic hydrocarbons (Reference 14). Table 6 presents the inhalation toxicity values used to evaluate exposure to petroleum mixtures. To be consistent with the methodology used in this assessment, the reference concentrations (RfCs) were converted to PRGs using Region 9 exposure assumptions. The resulting PRGs were used as the HBSLs for the petroleum hydrocarbons in this assessment. These values are presented in Appendix D.

**TABLE 6: SUMMARY OF RfCs USED FOR PETROLEUM HYDROCARBONS<sup>1</sup>**

Carbon Range	Aromatic Inhalation RfC (mg/m <sup>3</sup> )	Aliphatic Inhalation RfC (mg/m <sup>3</sup> )
C <sub>5</sub> – C <sub>6</sub>		18.4
C <sub>&gt;6</sub> – C <sub>8</sub>		
C <sub>&gt;7</sub> – C <sub>8</sub>	0.4	
C <sub>&gt;8</sub> – C <sub>10</sub>		
C <sub>&gt;10</sub> – C <sub>12</sub>	0.2	1.0
C <sub>&gt;12</sub> – C <sub>16</sub>		
C <sub>&gt;16</sub> – C <sub>21</sub>	NA	NA
C <sub>&gt;21</sub> – C <sub>35</sub>		

<sup>1</sup>Reference 15

NA = not applicable for high molecular weight TPHs (C<sub>>16</sub>) because substances in this carbon range are not volatile and therefore, inhalation is not a pathway of concern.

### 6.3.2 ACUTE ASSESSMENT

An established method for assessing acute health effects is not currently available. In 1995 the EPA recognized the need for acute exposure guidelines for emergency response purposes and created the National Advisory Committee for Acute Exposure Guideline Levels (AEGLs) for Hazardous Substances. Currently, AEGLs are available for only a few substances.

To overcome the absence of acute toxicity data for the purposes of human health risk assessment, several state regulatory agencies have suggested that guidelines developed for emergency purposes be used in the interim. Although suggestions have been made to use occupational exposure limits (OELs) by applying additional safety factors (References 16, 17), OELs were not used in this assessment because they introduce even more uncertainty than the use of emergency guidelines. The OELs are designed to protect the workplace environment and assume 8 hours a

<sup>1</sup> Aliphatic hydrocarbons are hydrocarbons in which the carbon atoms are joined by single covalent bonds consisting of two shared electrons (e.g., butane). Aromatic hydrocarbons have ring structures (e.g., benzene) (Reference 15).

day, 5 days a week exposures. By definition, these exposures are more chronic than acute.

In comparison, emergency planning guidelines are more appropriate because they are typically developed for exposures of 1-hour or less. In addition, safety factors are included as part of the guideline development so that the values would be protective of the general population.

Emergency Response Planning Guidelines (ERPGs) published by the American Industrial Hygiene Association (AIHA) (Reference 18) and the Temporary Emergency Exposure Limits (TEELs) developed by the U.S. Department of Energy (DOE) (Reference 19) were used for this assessment, specifically the ERPG-1s and the TEEL-1s. Since TEEL-1s are intended for exposures up to 15-minutes, air concentrations compared to TEELs were averaged over a 15-minute period. Air concentrations compared to ERPGs and AEGLs were averaged over 1-hour, as these values are intended for 1-hour exposures.

For this study, the hierarchy of sources for ATV selection was as follows with each ATV defined below:

- EPA AEGL-1. "AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic, nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure."
- AIHA ERPG-1. "The maximum concentration in air below which it is believed nearly all individuals could be exposed for up to 1- hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor."
- DOE TEEL-1. "The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor."

AEGLs were used first when available since they are developed specifically for the purpose of acute exposure assessments. The ERPGs were selected next, prior to a substance's TEEL, because they are vigorously reviewed before they are published whereas the TEELs are not.

Example 7 shows a sample calculation of how a substance's estimated acute concentration was compared to its ATV.

**Example 7**

**Sample Calculation of Comparing a Substance's Estimated Acute Concentration to Its Acute Toxicity Value:**

$$\frac{C_{\text{acute(HCl)}}}{ATV} = \frac{2.14E - 01}{4.50E + 03}$$
$$= 4.76E-05 < 1$$

In this example with HCl from the M918, the ratio is less than one, indicating that further analysis is not necessary.

## 7. RISK CHARACTERIZATION

As previously described, the exposure assessment included calculations of time-averaged concentrations for both long-term (chronic) and short-term (acute) exposures. Using a screening approach, a substance's estimated time-averaged air concentration was then compared to chronic HBSLs or ATVs. The comparison was made using the ratio of the HBSL or ATV to the estimated concentration. This approach is conservative because the exposure assumptions used by the EPA, to establish HBSLs and ATVs, are likely to overestimate the exposures experienced by offsite residents living near training areas.

If this ratio was less than one, no further evaluation was needed. If the chronic or acute averaged concentrations ( $C_{\text{chronic}}$  and  $C_{\text{acute}}$ ) were greater than the screening levels, resulting in a ratio greater than one, further evaluation would be warranted to determine the potential for health effects. Note that concentrations greater than the screening levels do not indicate an onset of health effects, but rather, the potential for such.

The chronic and acute assessments were conducted as outlined in Section 6.3. Appendix D presents results from the M918 and M781 risk characterization.

### 7.1 CHRONIC HEALTH RISK

The outcome of the chronic assessment indicated that no chronic health effects are expected from breathing the air emissions from the M918 or the M781. Since the ratios for all substances were below one, further evaluation was not needed.

### 7.2 ACUTE HEALTH RISK

For the acute assessment, all ratios were below one, indicating that no acute health effects are expected from breathing the air emissions from the M918 or the M781. The ratios for all substances were less than one, indicating further analysis was not necessary.

### 7.3 FACT SHEETS

Appendix E includes a copy of the fact sheets submitted to the AEC. The fact sheets used results from this assessment to address health concerns related to inhalation of M918 and the M781 air emissions.

## 8. UNCERTAINTY DISCUSSION

The limitations inherent in modeling and the added conservatism of the assessment contribute to the uncertainty of the assessment results. The risk assessment methodology typically includes safety factors that are embedded in the toxicity data to ensure adequate protection of the general population, particularly, susceptible individuals such as the sick, elderly, and children. Table 7 identifies areas of uncertainty associated with this assessment.

**TABLE 7: TYPES OF UNCERTAINTY**

Issue	Uncertainty	Direction of Effect
<b>Modeling</b>		
Modeled versus real-time sampling	The air concentrations in this assessment were modeled. Actual air concentrations taken from the field may be higher or lower.	Varies
Frequency of use for the M918 and the M781	Actual frequency of use for these munitions during training exercises may be different from those stated in this report.	Varies
Hypothetical resident assumed to be located directly downwind	Unless the area around the training facility is populated, the chances that a person living directly downwind is low.	Overestimates
Use of worst-case meteorological conditions	To ensure that this assessment is applicable to most training areas, worst-case meteorological conditions were used in the air model.	Overestimates
<b>Exposure Assessment</b>		
Estimating time-averaged concentrations	Actual exposure from the M918 or the M781 is intermittent. If one were to plot a person's exposure profile, the plot would consist of a series of spikes. Since current risk assessment methodology does not allow the evaluation of the potential for health risks as a function of time, a single concentration, averaged over the exposure duration was used. In this assessment, the exposure durations used were 30 years and 1-hour or 15 minutes.	Varies
Chromium speciation	All chromium was assumed to be present as Cr(VI), which is more toxic than Cr(III).	Overestimates
Comparing estimated concentration to established screening levels	The Region 3 and Region 9 HBSLs were developed using different exposure assumptions than those in this assessment, resulting in more conservative screening levels.	Overestimates
Comparing estimated concentrations to established screening levels	Comparison to screening levels does not account for possible cumulative effects of exposure to more than one substance.	Underestimates

**TABLE 7: TYPES OF UNCERTAINTY**

Issue	Uncertainty	Direction of Effect
Screening assessment versus calculating an average daily intake	Calculating an average daily intake allows the use of scenario-specific assumptions. However, unless the ratio of concentration to screening level approaches one, a screening assessment is useful as a first-cut evaluation.	Varies
Exposure to other munitions	Other munitions are typically used during the same training exercise. These items may contain similar or different substances from those detected in the M918 or the M781.	Underestimates
<b>Toxicity Assessment</b>		
Lack of toxicity data	Some substances were not quantitatively evaluated because they have no known toxicity data.	Underestimates
Modifying and uncertainty factors for toxicity data	Modifying factors and uncertainty factors of varying degree are typically applied to toxicological values. These factors are used to conservatively account for extrapolating from animal studies for human health assessment, and to conservatively account for variation in human populations.	Overestimates

## 9. CONCLUSION

Using conservative assumptions, the assessment indicated that offsite residents who live as close as 100 meters directly downwind from training areas are safe from breathing air emissions from the M918 or the M781. It is believed that the assumptions contained in this analysis are conservative enough to be protective of all the population including the sick, elderly, and children.

## 10. RECOMMENDATIONS

The results from this assessment are intended for a hypothetical training facility, and actual results may vary depending on site-specific conditions. This study used conservative assumptions (e.g., worst-case meteorological conditions, receptor located directly downwind, etc.) and it is believed that most site-specific analyses would result in even lower concentrations. Therefore, the results from this assessment should be applicable to most training facilities, unless site-specific conditions vary significantly.

## 11. POINT OF CONTACT

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**APPENDIX A**

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**APPENDIX B**

**AIR DISPERSION MODELING OUTPUT DATA**

**Table B-1: Air Modeling Output Data for the Cartridge, 40-mm Target Practice, M918 (MK19 Mod3)**

Cartridge, 40-mm Target Practice, M918 (MK19 Mod3)			No. of rounds (l)	1 item
DODIC: B584			release duration (l):	2 seconds
Number of items per test firing => 20			Unit Concentration (UC):	1.64E-04 g/m <sup>3</sup>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	Total Mass of Pollutant Emitted Per Item (grams) M	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
<b>Permanent Gases</b>				
Ammonia (NH3)	5.25E+00	NA	8.52E-06	3.86E-03
Carbon Dioxide (CO2)	1.63E+03	NA	2.64E-03	1.20E+00
Carbon Monoxide (CO)	1.57E+03	NA	2.54E-03	1.15E+00
Oxides of Nitrogen (as NO)	3.86E+01	NA	6.26E-05	2.84E-02
Sulfur Dioxide (SO2)	5.24E-01	NA	ND	ND
<b>Acid Gases</b>				
Hydrogen Fluoride	1.30E-01	2.40E-01	ND	ND
Hydrogen Chloride	3.55E-01	2.40E-01	6.49E-07	2.94E-04
Hydrogen Bromide	2.10E-01	2.30E-01	ND	ND
Nitric Acid	7.85E-01	2.30E-01	1.44E-06	6.51E-04
Phosphoric Acid	2.15E-01	2.30E-01	ND	ND
Sulfuric Acid	5.00E-02	2.40E-01	ND	ND
<b>Cyanide</b>				
Particulate Cyanide	1.77E-01	1.21E-01	3.24E-07	1.47E-04
Hydrogen Cyanide	7.24E-01	1.26E-01	1.32E-06	6.00E-04
<b>Particulates</b>				
TSP	7.69E+01	NA	1.41E-04	6.37E-02
PM10	7.58E+01	6.60E-02	1.39E-04	6.28E-02
PM2.5	6.28E+01	1.00E-02	1.15E-04	5.21E-02
<b>Metals</b>				
Antimony	6.84E-01	8.85E-04	1.25E-06	5.67E-04
Arsenic	1.51E-03	8.85E-04	2.76E-09	1.25E-06
Barium	8.60E+00	3.01E-03	1.57E-05	7.13E-03
Beryllium	3.33E-04	3.54E-04	ND	ND

Table B-2: Air Modelling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540			No. of rounds (l) release duration (t): Unit Concentration (UC): 1.608E-04 (g/m <sup>3</sup> )/s)	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>			
	Net Explosive Weight (NEW) in lbs. => Number of items = 1	3.28	SF6 Leak Rate Dilution Factor => 0.939						
VOCs									
Dichlorodifluoromethane	3.762E-03	3.762E-03		ND	ND	ND	ND		
Methyl Chloride	1.594E-03	1.594E-03		ND	ND	ND	ND		
Dichlorotetrafluoroethane	4.683E-03	4.683E-03		ND	ND	ND	ND		
Vinyl Chloride	5.069E-03	5.069E-03		ND	ND	ND	ND		
1,3-Butadiene	1.790E-03	1.790E-03		ND	ND	ND	ND		
Methyl Bromide	3.073E-03	3.073E-03		ND	ND	ND	ND		
Ethyl Chloride	2.112E-03	2.112E-03		ND	ND	ND	ND		
Trichlorofluoromethane	3.934E-03	3.934E-03		ND	ND	ND	ND		
1,1-Dichloroethene	9.028E-03	6.696E-03	2.867E-05	8.739E-06	1.300E-02	1.045E-06	6.501E-03		
Dichloromethane	1.607E-01	5.722E-03	1.904E-03	5.806E-04	8.638E-01	6.945E-05	4.319E-01		
3-Chloropropene	2.754E-03	2.754E-03		ND	ND	ND	ND		
1,1,2-Trichloro-1,2,2-trifluoroethane	4.965E-03	5.750E-03		ND	ND	ND	ND		
1,1-Dichloroethane	3.159E-03	3.159E-03		ND	ND	ND	ND		
cis-1,2-Dichloroethene	3.295E-03	3.295E-03		ND	ND	ND	ND		
Trichloromethane	4.099E-03	4.099E-03		ND	ND	ND	ND		
1,2-Dichloroethane	3.443E-03	3.443E-03		ND	ND	ND	ND		
1,1,1-Trichloroethane	2.007E-02	1.095E-01		ND	ND	ND	ND		
Benzene	5.931E-02	2.329E-03	7.290E-04	2.223E-04	3.307E-01	2.659E-05	1.653E-01		
Carbon Tetrachloride	4.529E-03	4.529E-03		ND	ND	ND	ND		
1,2-Dichloropropane	3.419E-03	3.419E-03		ND	ND	ND	ND		
Trichloroethene	3.866E-03	3.866E-03		ND	ND	ND	ND		
cis-1,3-Dichloropropene	3.360E-03	3.360E-03		ND	ND	ND	ND		
trans-1,3-Dichloropropene	2.860E-03	2.860E-03		ND	ND	ND	ND		
1,1,2-Trichloroethane	3.877E-03	3.877E-03		ND	ND	ND	ND		
Toluene	5.333E-03	3.610E-03	2.118E-05	6.456E-06	9.606E-03	7.723E-07	4.803E-03		
1,2-Dibromoethane	5.844E-03	5.844E-03		ND	ND	ND	ND		
Tetrachloroethene	4.475E-03	4.475E-03		ND	ND	ND	ND		

Cartidge, 40-mm Target Practice, M918 (MK19 Mod3)			No. of rounds (l)	1 item
DODIC: B584			release duration (t):	2 seconds
Number of items per test firing => 20			Unit Concentration (UC):	1.64E-04 g/m <sup>3</sup>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Total Mass of Pollutant Emitted Per Item (grams) M	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
Chlorodifluoromethane	3.54E-03	1.06E-02	6.47E-09	2.93E-06
Freon 14	6.99E-03	2.10E-02	ND	ND
Chloromethane	1.45E-03	6.20E-03	2.64E-09	1.20E-06
Vinyl Chloride	1.28E-03	7.67E-03	3.51E-09	1.59E-06
1,3-Butadiene	4.42E-03	6.64E-03	6.07E-09	2.75E-06
Bromomethane	3.88E-03	1.16E-02	ND	ND
Chloroethane	2.64E-03	7.92E-03	ND	ND
Dichlorofluoromethane	4.21E-03	1.26E-02	ND	ND
Trichlorofluoromethane	1.69E-03	1.69E-02	3.08E-09	1.40E-06
Acrolein	2.33E-01	6.88E-03	4.25E-07	1.93E-04
1,1-Dichlorethane	4.05E-03	1.21E-02	ND	ND
Freon 13	7.68E-03	2.30E-02	ND	ND
Methyl Iodide	5.81E-03	1.74E-02	ND	ND
Carbon Disulfide	2.18E-03	9.34E-03	3.99E-09	1.81E-06
Acetonitrile	8.56E-02	3.36E-03	1.51E-07	6.85E-05
3-Chloropropene	3.13E-03	9.39E-03	ND	ND
Methylene Chloride	1.56E-01	7.99E-02	1.56E-07	7.07E-05
tert-Butyl Alcohol	7.58E-02	9.09E-03	7.19E-08	3.26E-05
Acrylonitrile	1.02E-01	6.51E-03	1.86E-07	8.46E-05
trans-1,2-Dichloroethene	3.96E-03	1.19E-02	ND	ND
Methyl t-Butyl Ether	3.61E-03	1.08E-02	ND	ND
Hexane	1.08E+00	3.88E+00	ND	ND
1,1-Dichloroethane	3.97E-03	1.19E-02	ND	ND
Vinyl Acetate	3.52E-03	1.06E-02	ND	ND
cis-1,2-Dichloroethene	3.96E-03	1.19E-02	ND	ND
2-Butanone	4.42E-03	8.85E-03	8.08E-09	3.67E-06
Ethy Acetate	3.60E-03	1.08E-02	ND	ND

**Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location**

Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)	No. of rounds (l) release duration (t): 1.608E-04 (g/m <sup>3</sup> )/(g/s)	Substance Emission Rate for One Round (g/sec)	
							M	CONC
<b>SVOCs</b>								
n-nitrosodimethylamine	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
phenol	7.294E-03	7.120E-03	2.148E-06	6.548E-07	9.742E-04	7.833E-08	4.871E-04	ND
2-chlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.355E-03	5.684E-05	ND	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
benzyl alcohol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
2-methyphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
hexachloroethane	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
4-methylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
nitrobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
isophorone	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
2-nitrophenol	2.355E-03	3.660E-04	ND	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
naphthalene	3.597E-03	1.366E-04	4.253E-05	1.297E-06	1.929E-02	1.551E-06	9.647E-03	ND
4-chloroaniline	2.355E-02	5.605E-04	ND	ND	ND	ND	ND	ND
hexachlorobutadiene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
2-methylnaphthalene	2.355E-03	1.694E-04	ND	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND	ND

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Cartridge, 40-mm Target Practice, M918 (MK19 Mod3)			No. of rounds (l)	1 item
DODIC: B584			release duration (t):	2 seconds
Number of items per test firing => 20			Unit Concentration (UC):	1.64E-04 g/m <sup>3</sup>
<b>Target Results</b>				
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	Total Mass of Pollutant Emitted Per Item (grams) M
	(mg/m <sup>3</sup> )	(mg/m <sup>3</sup> )		(grams)
Ethylbenzene	1.52E-02	4.34E-03	2.07E-08	9.40E-06
m/p-Xylene	3.91E-02	2.17E-02	3.62E-08	1.64E-05
o-Xylene	2.61E-02	1.74E-02	1.94E-08	8.82E-06
Styrene	1.28E-02	1.28E-02	2.34E-08	1.06E-05
Bromoform	1.03E-02	3.10E-02	ND	ND
Cumene	9.83E-04	1.47E-02	5.40E-09	2.45E-06
1,1,2,2-Tetrachloroethane	6.87E-03	2.06E-02	ND	ND
1,2,3-Trichloropropane	6.03E-03	1.81E-02	ND	ND
Bromobenzene	6.42E-03	1.93E-02	ND	ND
4-Ethyltoluene	2.95E-03	1.47E-02	5.39E-09	2.45E-06
1,3,5-Trimethylbenzene	2.21E-03	1.47E-02	4.04E-09	1.83E-06
Alpha Methyl Styrene	4.83E-03	1.45E-02	ND	ND
1,2,4-Trimethylbenzene	4.92E-03	1.47E-02	8.99E-09	4.08E-06
1,3-Dichlorobenzene	6.01E-03	1.80E-02	ND	ND
1,4-Dichlorobenzene	6.01E-03	1.80E-02	ND	ND
Benzyl Chloride	5.18E-03	1.55E-02	ND	ND
1,2-Dichlorobenzene	6.01E-03	1.80E-02	ND	ND
Hexachloroethane	9.68E-03	2.90E-02	ND	ND
1,2,4-Trichlorobenzene	7.42E-03	2.23E-02	ND	ND
Hexachlorobutadiene	1.07E-02	3.20E-02	ND	ND
<b>VOC Tentatively Identified Compounds (TICs)</b>				
Propyne (confirmation)	3.77E-02	ND	6.89E-08	3.13E-05
1-Chloro-1,1-difluoroethane	3.08E-02	ND	5.64E-08	2.56E-05
Isobutene (confirmation)	2.43E-01	ND	4.44E-07	2.01E-04
Acetaldehyde (confirmation)	3.78E-02	ND	6.92E-08	3.14E-05
1-Buten-3-yne	1.17E-02	ND	2.14E-08	9.71E-06
Ethylcyclopropane	2.15E-02	ND	3.93E-08	1.78E-05

**Table B-4: Air Modelling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
**100 meter location**

165mm propelling charge M3 (zone 3), M199 cannon DODIC: D540		No. of rounds (l) release duration (t): 1.608E-04 (g/m <sup>3</sup> )/(g/s)					
Net Explosive Weight (NEW) in lbs. => 3.28 Number of items = 1 SF6 Leak Rate Dilution Factor => 0.939		Unit Concentration (UC):					
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
PAHs (TO-13 Method)							
acenaphthylene	4.939E-04	1.328E-06	6.054E-06	1.846E-06	2.746E-03	2.208E-07	1.373E-03
acenaphthene	1.464E-04	9.544E-05	6.269E-07	1.911E-07	2.843E-04	2.286E-08	1.422E-04
fluorene	2.220E-04	6.502E-05	1.930E-06	5.884E-07	8.754E-04	7.038E-08	4.377E-04
phenanthrene	5.217E-04	6.428E-05	5.622E-06	1.714E-06	2.550E-03	2.050E-07	1.275E-03
anthracene	5.075E-05	4.197E-06	5.721E-07	1.744E-07	2.595E-04	2.087E-08	1.298E-04
fluoranthene	3.162E-04	7.852E-06	3.790E-06	1.156E-06	1.719E-03	1.382E-07	8.594E-04
pyrene	8.843E-04	6.908E-06	1.078E-05	3.288E-06	4.892E-03	3.933E-07	2.446E-03
benzo(a)anthracene	4.504E-05	1.390E-07	5.518E-07	1.682E-07	2.503E-04	2.012E-08	1.252E-04
chrysene	4.510E-05	3.878E-07	5.496E-07	1.676E-07	2.493E-04	2.004E-08	1.246E-04
benzo(b)fluoranthene	6.923E-05	2.220E-07	8.482E-07	2.586E-07	3.847E-04	3.093E-08	1.924E-04
benzo(k)fluoranthene	9.756E-05	9.826E-08	1.198E-06	3.652E-07	5.434E-04	4.366E-08	2.717E-04
benzo(a)pyrene	1.560E-04	8.980E-08	1.917E-06	5.843E-07	8.693E-04	6.989E-08	4.347E-04
indeno(1,2,3-cd)pyrene	2.926E-04	1.659E-07	3.595E-06	1.096E-06	1.630E-03	1.311E-07	8.152E-04
dibenz(a,h)anthracene	1.008E-05	5.605E-08	1.238E-07	3.776E-08	5.618E-05	4.517E-09	2.809E-05
benzo(g,h,i)perylene	6.659E-04	2.408E-07	8.181E-06	2.494E-06	3.711E-03	2.984E-07	1.8566E-03
Dioxin/Furan Data							
2378-TCDD	4.360E-10	8.000E-12	5.359E-12	1.634E-12	2.431E-09	1.954E-13	1.215E-09
12378-PECDD	1.341E-09	9.000E-12	1.637E-11	4.991E-12	7.426E-09	5.970E-13	3.713E-09
123478-HXCDD	1.989E-09	1.060E-11	2.445E-11	7.453E-12	1.109E-08	8.916E-13	5.544E-09
123678-HXCDD	5.812E-09	1.700E-11	7.122E-11	2.171E-11	3.230E-08	2.597E-12	1.615E-08
123789-HXCDD	5.536E-09	1.550E-11	6.785E-11	2.068E-11	3.077E-08	2.474E-12	1.539E-08
1234678-HPCDD	1.137E-07	2.495E-10	1.395E-09	4.252E-10	6.322E-07	5.087E-11	3.163E-07
OCDD	6.470E-07	1.587E-09	7.932E-09	2.418E-09	3.598E-06	2.893E-10	1.798E-06
2378-TCDF	1.560E-10	1.100E-11	1.782E-12	5.433E-13	8.084E-10	6.499E-14	4.042E-10
12378-PECDF	2.870E-10	1.050E-11	ND	ND	ND	ND	ND
23478-PECDF	1.870E-10	1.550E-11	2.108E-12	6.427E-13	9.561E-10	7.687E-14	4.781E-10
123478-HXCDF	3.965E-10	2.800E-11	4.529E-12	1.381E-12	2.054E-09	1.652E-13	1.027E-09
123678-HXCDF	2.380E-10	1.450E-11	2.747E-12	8.375E-13	1.246E-09	1.002E-13	6.230E-10
123789-HXCDF	3.015E-10	6.000E-12	ND	ND	ND	ND	ND

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Cartridge, 40-mm Target Practice, M918 (MK19 Mod3)		No. of rounds (l) release duration (t):	1 item 2 seconds
DODIC: B584		Unit Concentration (UC):	1.64E-04 g/m <sup>3</sup>
Number of items per test firing => 20		Total Mass of Pollutant Emitted Per Item (grams) M	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
<b>ATTACHMENT TEST Results 1</b>			
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)
phenol	1.71E-02	1.81E-02	ND
2-chlorophenol	1.71E-02	1.81E-02	ND
1,3-dichlorobenzene	1.71E-02	1.81E-02	ND
1,4-dichlorobenzene	1.71E-02	1.81E-02	ND
1,2-dichlorobenzene	1.71E-02	1.81E-02	ND
benzyl alcohol	1.71E-02	1.81E-02	ND
bis(2-chloroisopropyl)ether	1.71E-02	1.81E-02	ND
2-methylphenol	1.71E-02	1.81E-02	ND
hexachloroethane	1.71E-02	1.81E-02	ND
n-nitroso-di-n-propylamine	1.71E-02	1.81E-02	ND
4-methylphenol	1.71E-02	1.81E-02	ND
nitrobenzene	1.71E-02	1.81E-02	ND
isophorone	1.71E-02	1.81E-02	ND
2-nitrophenol	1.71E-02	1.81E-02	ND
2,4-dimethylphenol	1.71E-02	1.81E-02	ND
bis(2-chloroethoxy)methane	1.71E-02	1.81E-02	ND
2,4-dichlorophenol	1.71E-02	1.81E-02	ND
Benzoic Acid	7.38E-02	3.79E-02	7.34E-08
1,2,4-trichlorobenzene	1.71E-02	1.81E-02	ND
4-chloroaniline	3.42E-02	3.61E-02	ND
hexachlorobutadiene	1.71E-02	1.81E-02	ND
4-chloro-3-methylphenol	1.71E-02	1.81E-02	ND
2-methylnaphthalene	1.71E-02	1.81E-02	ND
hexachlorocyclopentadiene	1.71E-02	1.81E-02	ND
2,4,6-trichlorophenol	1.71E-02	1.81E-02	ND
2,4,5-trichlorophenol	1.71E-02	1.81E-02	ND
2-chloronaphthalene	1.71E-02	1.81E-02	ND

**Table B-5: Air Modeling Output Data for Cyanide and Energetics - 100 meter location**

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540		No. of rounds (l) release duration (t): Unit Concentration (UC):	1.608E-04 (g/m <sup>3</sup> )/(g/s)	1 rounds 2 seconds
Net Explosive Weight (NEW) in lbs. => 3.28 Number of items = 1 SF6 Leak Rate Dilution Factor => 0.939		Total Mass of Substance Emitted (grams/item)	M	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)
<b>Particulate Cyanide and HCN</b>	8.0000E-02	8.0000E-02	ND	ND
Particulate Cyanide	8.0000E-02	8.0000E-02	ND	ND
Hydrogen Cyanide	9.5000E-01	8.5000E-02	1.1688E-02	3.5600E-03
<b>Energetics Data</b>				
Nitrobenzene	5.021E-01	2.031E-01	ND	ND
2-Nitrotoluene	5.021E-01	2.031E-01	ND	ND
3-Nitrotoluene	5.021E-01	2.031E-01	ND	ND
4-Nitrotoluene	5.021E-01	2.031E-01	ND	ND
Nitroglycerine	5.021E-01	2.031E-01	ND	ND
1,3-Dinitrobenzene	5.021E-01	2.031E-01	ND	ND
2,6-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND
2,4-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND
1,3,5-Trinitrobenzene	5.021E-01	2.031E-01	ND	ND
2,4,6-Trinitrotoluene	5.021E-01	2.031E-01	ND	ND
RDX	5.021E-01	2.031E-01	ND	ND
4-Amino-2,6-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND
2-Amino-4,6-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND
Tetryl	5.021E-01	2.031E-01	ND	ND
HMX	1.004E+00	4.062E-01	ND	ND
Pentaerythritoltetranitrate	1.004E+00	4.062E-01	ND	ND
Dibutyl phthalate	2.510E+01	1.016E+01	ND	ND
Diocetyl phthalate	2.510E+01	1.016E+01	ND	ND
Diphenylamine	1.255E+01	5.078E+00	ND	ND

Footnotes:

<sup>1</sup>ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Cartridge, 40-mm Target Practice, M918 (MK19 Mod3) DODIC: B584		No. of rounds (l): release duration (t):	
Number of items per test firing => 20		Unit Concentration (UC): 1.64E-04 g/m <sup>3</sup>	
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
Hexyl-cyclohexane	ND	ND	ND
Dodecamethylcyclohexasiloxane	1.50E-02	4.52E-08	2.05E-05
Dodecanoic Acid	ND	ND	ND
Hexadecanoic Acid	2.05E-02	8.20E-03	5.09E-08
Octadecanoic Acid	1.65E-02	ND	5.13E-08
bis(2-ethylhexyl)Decanedioic Acid	4.70E-01	ND	1.46E-06
<b>TO-13 (PAHs)</b>			
naphthalene	1.24E-02	2.35E-04	2.22E-08
acenaphthylene	1.79E-03	1.81E-05	3.28E-09
acenaphthene	1.78E-04	4.69E-05	2.50E-10
fluorene	3.83E-04	4.51E-05	6.27E-10
phenanthrene	5.27E-04	1.12E-04	7.81E-10
anthracene	9.70E-05	2.53E-05	1.36E-10
fluoranthene	3.50E-04	6.32E-05	5.37E-10
pyrene	6.65E-04	5.60E-05	1.13E-09
benzo(a)anthracene	1.79E-04	5.05E-05	2.46E-10
chrysene	1.09E-04	4.87E-05	1.20E-10
benzo(b)fluoranthene	1.24E-04	5.42E-05	1.38E-10
benzo(k)fluoranthene	2.05E-04	4.87E-05	2.95E-10
benzo(a)pyrene	2.06E-04	3.61E-05	3.18E-10
indeno(1,2,3-cd)pyrene	1.73E-04	3.97E-05	2.52E-10
dibenz(a,h)anthracene	5.44E-05	4.15E-05	3.21E-11
benzog(h,i)perylene	4.86E-04	4.15E-05	8.21E-10
<b>Dioxins/Furans</b>			
2378-TCDD	2.30E-09	5.01E-09	ND
12378-PECDD	3.69E-09	3.58E-09	ND
123478-HXCDD	1.56E-09	1.47E-09	ND

Cartridge, 40-mm Target Practice, M918 (MK19 Mod3)			No. of rounds (l):	1 item
DODIC: B584			release duration (t):	2 seconds
Number of items per test firing => 20			Unit Concentration (UC):	1.64E-04 g/m <sup>3</sup>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	Total Mass of Pollutant Emitted Per Item (grams) M
				Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
				Pollutant Emission Rate for One Item (g/sec) ER <sub>1</sub>
HMX	6.68E-03	7.12E-03	ND	ND
Pentaerythritoltetranitrate	6.68E-03	7.12E-03	ND	ND
Diphenylamine	8.35E-02	8.90E-02	ND	ND

Footnotes:

<sup>1</sup>ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emission Study Report)

NA = Not Applicable

ND = Not Detected

**TABLE B-2**

**M781 (M203)**

**Table B-2: Air Modeling Output Data for the Cartridge, 40-mm Target Practice, M781 (M203)**

Cartridge, 40-mm Target Practice, M781 (M203)			No. of rounds (l):	1 item
DODIC: B619			release duration (t):	2 seconds
Number of items per test firing => 14			Unit Concentration (UC):	2.03E-04 g/m <sup>3</sup>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Total Mass of Pollutant Emitted Per Item (grams) M	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
<b>Permanent Gases</b>				
Ammonia (NH <sub>3</sub> )	2.10E+00	NA	ND	ND
Carbon Dioxide (CO <sub>2</sub> )	2.36E+02	NA	2.52E-04	1.14E-01
Carbon Monoxide (CO)	3.25E+02	NA	3.48E-04	1.58E-01
Oxides of Nitrogen (as NO)	2.18E+01	NA	2.33E-05	1.60E-05
Sulfur Dioxide (SO <sub>2</sub> )	5.24E-01	NA	ND	1.07E-06
<b>Acid Gases</b>				
Hydrogen Fluoride	2.20E-01	2.10E-01	ND	ND
Hydrogen Chloride	3.25E-01	2.00E-01	ND	ND
Hydrogen Bromide	2.10E-01	2.00E-01	ND	ND
Nitric Acid	3.25E-01	2.00E-01	ND	ND
Phosphoric Acid	2.10E-01	2.00E-01	ND	1.24E-04
Sulfuric Acid	1.15E-01	2.00E-01	ND	1.26E-08
<b>Cyanide</b>				
Particulate Cyanide	1.00E-01	1.00E-01	ND	ND
Hydrogen Cyanide	4.95E-01	1.00E-01	5.96E-07	2.70E-04
<b>Particulates</b>				
TSP	1.87E+01	NA	3.40E-05	1.54E-02
PM10	2.14E+01	8.50E-02	3.84E-05	1.74E-02
PM2.5	1.89E+01	6.10E-02	3.41E-05	1.55E-02
<b>Metals</b>				
Antimony	1.00E+00	1.14E-03	1.20E-06	5.46E-04
Arsenic	1.12E-03	1.14E-03	ND	5.54E-08
Barium	5.40E-01	2.27E-03	6.47E-07	ND
Beryllium	4.50E-04	4.55E-04	ND	2.93E-04
				2.98E-08
				1.47E-04
				ND
				ND

Cartridge, 40-mm Target Practice, M781 (M203)			No. of rounds (t)	1 item
DODIC: B519			release duration (t):	2 seconds
Number of items per test firing => 14			Unit Concentration (UC):	2.03E-04 g/m <sup>3</sup>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Total Mass of Pollutant Emitted Per Item (grams) M	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
	(mg/m <sup>3</sup> )	(mg/m <sup>3</sup> )		
Cadmium	1.12E-03	1.14E-03	ND	ND
Chromium	1.19E-02	1.14E-03	1.43E-08	6.50E-06
Cobalt	4.50E-04	4.55E-04	ND	ND
Copper	6.52E-02	7.50E-03	7.04E-08	3.19E-05
Lead	5.40E+00	4.55E-03	6.49E-06	2.95E-03
Manganese	9.22E-04	4.55E-04	1.11E-09	5.03E-07
Nickel	1.12E-03	1.14E-03	ND	ND
Selenium	2.25E-03	2.27E-03	ND	ND
Silver	4.50E-04	4.55E-04	ND	ND
Thallium	1.12E-03	1.14E-03	ND	ND
Zinc	3.37E+00	2.27E-02	4.06E-06	1.84E-03
<i>TO-11 Carbonyls</i>				
Formaldehyde	7.37E-02	1.23E-02	8.86E-08	4.02E-05
Acetdehyde	5.40E-02	1.80E-02	6.50E-08	2.95E-05
Acetone	5.94E-02	4.75E-02	2.06E-08	9.36E-06
Propionaldehyde	2.37E-02	2.37E-02	ND	ND
Crotonaldehyde	2.87E-02	2.87E-02	ND	ND
Butyraldehyde	2.95E-02	2.95E-02	ND	ND
Benzaldehyde	4.34E-02	4.34E-02	ND	ND
Isovaleraldehyde	3.52E-02	3.52E-02	ND	ND
Valeraldehyde	3.52E-02	3.52E-02	ND	ND
o,m,p-Toluualdehyde	9.83E-02	9.83E-02	ND	ND
Hexaldehyde	4.10E-02	4.10E-02	ND	ND
2,5-Dimethylbenzaldehyde	4.10E-02	4.10E-02	ND	ND
VOCs				
Propene	7.31E-02	8.61E-04	8.70E-08	3.95E-05
Dichlorodifluoromethane	1.98E-03	2.47E-03	ND	ND

Cartridge, 40-mm Target Practice, M781 (M203)		No. of rounds (l) release duration (t):	
DDIC: B519		2 seconds	
Number of items per test firing => 14		Unit Concentration (UC): 2.03E-04 g/m <sup>3</sup>	
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	Total Mass of Pollutant Emitted Per Item (grams) M
	Measured Background Concentration (mg/m <sup>3</sup> )		Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
Chlorodifluoromethane	3.54E-03	3.54E-03	ND
Freon 114	6.99E-03	6.99E-03	ND
Chloromethane	1.45E-03	1.45E-03	ND
Vinyl Chloride	2.56E-03	2.56E-03	ND
1,3-Butadiene	8.85E-03	2.21E-03	5.64E-10
Bromomethane	3.88E-03	3.88E-03	ND
Chloroethane	2.64E-03	2.64E-03	ND
Dichlorofluoromethane	4.21E-03	4.21E-03	ND
Trichlorofluoromethane	1.69E-03	1.69E-03	ND
Acrolein	1.35E-01	2.29E-03	ND
1,1-Dichlorethane	4.05E-03	4.05E-03	ND
Freon 113	7.68E-03	7.68E-03	ND
Methyl Iodide	5.81E-03	5.81E-03	ND
Carbon Disulfide	1.11E-01	3.11E-03	ND
Acetonitrile	5.29E-02	3.36E-03	ND
3-Chloropropene	3.13E-03	3.13E-03	ND
Methylene Chloride	3.20E-01	5.56E-02	ND
tert-Butyl Alcohol	1.52E-03	2.43E-03	ND
Acrylonitrile	7.81E-02	2.17E-03	9.39E-08
trans-1,2-Dichloroethene	3.96E-03	3.96E-03	ND
Methyl t-Butyl Ether	3.61E-03	3.61E-03	ND
Hexane	1.45E-01	2.11E-02	1.51E-07
1,1-Dichloroethane	3.97E-03	3.97E-03	ND
Vinyl Acetate	3.52E-03	3.52E-03	ND
cis-1,2-Dichloroethene	3.96E-03	3.96E-03	ND
2-Butanone	4.42E-03	2.95E-03	5.33E-09
Ethyl Acetate	3.60E-03	3.60E-03	ND

Cartridge, 40-mm Target Practice, M781 (M203)		No. of rounds (1)	
DODIC: B519		release duration (t):	
Number of items per test firing => 14		Unit Concentration (UC):	
		2.03E-04 g/m <sup>3</sup>	
		Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC	Pollutant Emission Rate for One Item (g/sec) ER <sub>1</sub>
Compound		Total Mass of Pollutant Emitted Per Item (grams) M	
Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	
Methyl Acrylate	3.52E-03	3.52E-03	ND
Chloroform	4.88E-03	4.88E-03	ND
1,1,1-Trichloroethane	1.34E-01	3.82E-02	1.20E-07
Carbon Tetrachloride	1.26E-03	6.29E-03	4.53E-09
1,2-Dichlorethane	8.09E-03	4.05E-03	9.74E-09
Benzene	5.59E-01	6.39E-04	6.72E-07
Isooctane	4.67E-03	4.67E-03	ND
Heptane	4.10E-03	4.10E-03	ND
Trichloroethane	4.88E-03	4.88E-03	ND
Ethyl Acrylate	4.09E-03	4.09E-03	ND
1,2-Dichloropropane	4.62E-03	4.62E-03	ND
Methyl Methacrylate	4.09E-03	4.09E-03	ND
Dibromomethane	7.11E-03	7.11E-03	ND
1,4-Dioxane	3.60E-03	3.60E-03	ND
Bromodichloromethane	6.70E-03	6.70E-03	ND
4-Methyl-2-Pentanone	4.10E-03	4.10E-03	ND
Toluene	7.16E-02	7.54E-04	8.54E-08
Octane	1.17E-03	4.67E-03	1.41E-09
trans-1,3-Dichloropropene	4.54E-03	4.54E-03	ND
Ethyl Methacrylate	4.67E-03	4.67E-03	ND
1,1,2-Trichloroethane	5.46E-03	5.46E-03	ND
Tetrachloroethylene	6.78E-03	6.78E-03	ND
2-Hexanone	4.10E-03	4.10E-03	ND
Dibromochloromethane	8.52E-03	8.52E-03	ND
1,2-Dibromoethane	7.68E-03	7.68E-03	ND
Chlorobenzene	4.60E-03	4.60E-03	ND
1,1,1,2-Tetrachloroethane	6.87E-03	6.87E-03	ND

Cartridge, 40-mm Target Practice, M781 (M203)		No. of rounds (t)	1 item
DODIC: B519		release duration (t):	2 seconds
Number of items per test firing => 14		Unit Concentration (UC):	2.03E-04 g/m <sup>3</sup>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	Total Mass of Pollutant Emitted Per Item (grams) M
	Background Concentration (mg/m <sup>3</sup> )	(mg/m <sup>3</sup> )	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
Ethylbenzene	2.61E-02	8.68E-03	2.20E-08
m/p-Xylene	8.68E-02	2.61E-02	7.66E-08
o-Xylene	6.95E-02	2.61E-02	5.56E-08
Sterene	1.98E-01	4.26E-03	2.38E-07
Bromoform	1.03E-02	1.03E-02	ND
Cumene	4.42E-03	1.47E-03	3.74E-09
1,1,2,2-Tetrachlorethane	6.87E-03	6.87E-03	ND
1,2,3-Trichloropropane	6.03E-03	6.03E-03	ND
Bromobenzene	6.42E-03	6.42E-03	ND
4-Ethyltoluene	3.69E-02	1.47E-02	2.85E-08
1,3,5-Trimethylbenzene	2.21E-02	9.83E-03	1.61E-08
Alpha Methyl Styrene	4.83E-03	4.83E-03	ND
1,2,4-Trimethylbenzene	6.64E-02	2.46E-02	5.35E-08
1,3-Dichlorobenzene	6.01E-03	6.01E-03	ND
1,4-Dichlorobenzene	6.01E-03	6.01E-03	ND
Benzyl Chloride	5.18E-03	5.18E-03	ND
1,2-Dichlorobenzene	6.01E-03	6.01E-03	ND
Hexachlorethane	9.68E-03	9.68E-03	ND
1,2,4-Trichlorobenzene	7.42E-03	7.42E-03	ND
Hexachlorobutadiene	1.07E-02	1.07E-02	ND
VOC Tentatively Identified Compounds (TICs)			
Propyne (confirmation)	3.52E-02	ND	4.24E-08
1-Chloro-1,1-difluoroethane	ND	ND	1.92E-05
Isobutene (confirmation)	2.64E-02	ND	3.17E-08
Acetaldehyde (confirmation)	2.88E-02	1.08E-02	2.31E-08
1-Buten-3-yne	1.07E-02	ND	6.39E-09
Ethylcyclopropane	ND	ND	ND

Cartridge 40-mm Target Practice, M781 (M203)		No. of rounds (1)		1 item
DODIC: B519		release duration (t):		2 seconds
Number of items per test firing => 14		Unit Concentration (UC):		2.03E-04 g/m <sup>3</sup>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	Total Mass of Pollutant Emitted Per Item (grams) M
Ethanol	1.13E-02	5.28E-02	ND	ND
Furan	1.39E-02	ND	1.67E-08	7.67E-06
1-Hexene	ND	ND	ND	ND
Thiirane	2.95E-02	ND	3.55E-08	1.61E-05
Thiophene	1.38E-02	ND	1.68E-08	7.49E-06
2,2,4-Trimethyl-1-pentene	ND	ND	ND	ND
Undecane	1.34E-01	6.39E-03	1.55E-07	7.03E-05
3-Methyl-undecane	4.18E-02	ND	5.04E-08	2.29E-05
Dodecane	1.39E-01	ND	1.68E-07	7.62E-05
2,6-Dimethyl-undecane	5.28E-02	ND	6.37E-08	2.89E-05
<b>Hydrocarbons</b>				
Methane	4.69E+00	1.64E+00	3.89E-06	1.76E-03
Ethylene	1.43E+00	2.29E-02	1.72E-06	7.82E-04
Acetylene	1.17E+00	2.13E-02	1.41E-06	6.39E-04
Ethane	6.40E-02	2.46E-02	7.69E-08	3.49E-05
Propane	3.61E-02	3.61E-02	ND	ND
Propyne	5.68E-02	3.20E-02	6.83E-08	3.10E-05
Isobutane	4.75E-02	4.75E-02	ND	ND
1-Butene/isobutylene	6.54E-02	4.59E-02	7.87E-08	3.57E-05
Butane	4.75E-02	4.75E-02	ND	ND
1-Butyne/cis-Butene	4.59E-02	4.59E-02	ND	ND
trans-Butene	4.59E-02	4.59E-02	ND	ND
2-Butyne	4.42E-02	4.42E-02	ND	ND
n-Pentane	5.90E-02	5.90E-02	ND	ND
<b>SVOCS</b>				
n-nitrosodimethylamine	1.77E-02	1.78E-02	ND	ND
bis(2-chloroethyl)ether	1.77E-02	1.78E-02	ND	ND

Cartridge, 40-mm Target Practice, M781 (M203)		No. of rounds (l) release duration (t):		1 item 2 seconds	
DCDIC: B519		Unit Concentration (Uc):		2.03E-04 g/m <sup>3</sup>	
Number of items per test firing => 14		Total Mass of Pollutant Emitted Per Item (grams) M		Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC	Pollutant Emission Rate for One Item (g/sec) ER <sub>1</sub>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)		
phenol	1.77E-02	1.78E-02	ND	ND	ND
2-chlorophenol	1.77E-02	1.78E-02	ND	ND	ND
1,3-dichlorobenzene	1.77E-02	1.78E-02	ND	ND	ND
1,4-dichlorobenzene	1.77E-02	1.78E-02	ND	ND	ND
1,2-dichlorobenzene	1.77E-02	1.78E-02	ND	ND	ND
benzyl alcohol	1.77E-02	1.78E-02	ND	ND	ND
bis(2-chloroisopropyl)ether	1.77E-02	1.78E-02	ND	ND	ND
2-methylphenol	1.77E-02	1.78E-02	ND	ND	ND
hexachloroethane	1.77E-02	1.78E-02	ND	ND	ND
n-nitroso-di-n-propylamine	1.77E-02	1.78E-02	ND	ND	ND
4-methylphenol	1.77E-02	1.78E-02	ND	ND	ND
nitrobenzene	1.77E-02	1.78E-02	ND	ND	ND
isophorone	1.77E-02	1.78E-02	ND	ND	ND
2-nitrophenol	1.77E-02	1.78E-02	ND	ND	ND
2,4-dimethylphenol	1.77E-02	1.78E-02	ND	ND	ND
bis(2-chloroethoxy)methane	1.77E-02	1.78E-02	ND	ND	ND
2,4-dichlorophenol	1.77E-02	1.78E-02	ND	ND	ND
Benzoic Acid	9.15E-02	3.92E-02	6.72E-08	3.05E-05	3.10E-09
1,2,4-trichlorobenzene	1.77E-02	1.78E-02	ND	ND	1.53E-05
4-chloroaniline	3.55E-02	3.57E-02	ND	ND	ND
hexachlorobutadiene	1.77E-02	1.78E-02	ND	ND	ND
4-chloro-3-methylphenol	1.77E-02	1.78E-02	ND	ND	ND
2-methylnaphthalene	1.77E-02	1.78E-02	ND	ND	ND
hexachlorocyclopentadiene	1.77E-02	1.78E-02	ND	ND	ND
2,4,6-trichlorophenol	1.77E-02	1.78E-02	ND	ND	ND
2,4,5-trichlorophenol	1.77E-02	1.78E-02	ND	ND	ND
2-chloronaphthalene	1.77E-02	1.78E-02	ND	ND	ND

Cartridge, 40-mm Target Practice, M781 (M203)		No. of rounds (1) released duration (t): 2 seconds	
DODIC: B519 Number of items per test firing => 14		Unit Concentration (UC): 2.03E-04 g/m <sup>3</sup>	
Compound	Total Mass of Pollutant Emitted Per Item (grams) M	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC	Pollutant Emission Rate for One Item (g/sec) ER <sub>1</sub>
Compound	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	
2-nitroaniline	1.77E-02	3.57E-02	ND
dimethylphthalate	1.77E-02	1.78E-02	ND
2,6-dinitrotoluene	1.77E-02	1.78E-02	ND
3-nitroaniline	3.55E-02	1.78E-02	ND
2,4-dinitrophenol	3.55E-02	1.78E-02	ND
dibenzofuran	1.77E-02	1.34E-02	ND
2,4-dinitrotoluene	1.77E-02	3.57E-02	ND
4-nitrophenol	3.55E-02	3.57E-02	ND
4-chlorophenyl-phenylether	1.77E-02	1.78E-02	ND
diethylphthalate	3.19E-02	1.78E-02	ND
4-nitroaniline	3.55E-02	3.57E-02	ND
4,6-dinitro-2-methylphenol	3.55E-02	1.78E-02	ND
n-nitrosodiphenylamine(1)	1.77E-02	1.78E-02	ND
4-bromophenyl-phenylether	1.77E-02	1.78E-02	ND
hexachlorobenzene	1.77E-02	1.78E-02	ND
pentachlorophenol	3.55E-02	1.78E-02	ND
di-n-butylphthalate	2.57E-02	1.78E-02	ND
butylbenzylphthalate	1.77E-02	1.78E-02	ND
3,3-dichlorobenzidine	3.55E-02	3.57E-02	ND
bis(2-ethylhexyl)phthalate	3.01E-01	9.63E-02	2.56E-07
di-n-octylphthalate	1.77E-02	1.78E-02	ND
<b>SVOC Tentatively Identified Compounds (TICs)</b>			
Acetophenone	2.00E-02	ND	4.24E-08
Pheno (to be added to Form I)	5.80E-03	ND	1.22E-08
Benzonitrile	8.90E-03	ND	1.88E-08
Undecane	2.40E-02	ND	5.09E-08
Dodecane	3.14E-02	ND	6.66E-08

Cartridge, 40-mm Target Practice, M781 (M203)		No. of rounds (l) release duration (t):	
DODIC: B519		2 seconds	
Number of items per test firing => 14		Unit Concentration (UC):	
<del>TEST ITEM CONCENTRATION</del>		Total Mass of Pollutant Emitted Per Item (grams) M	
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
Hexyl-cyclohexane	1.60E-02	ND	3.40E-08
Dodecamethylcyclohexasiloxane	1.18E-02	ND	2.49E-08
Dodecanoic Acid	9.30E-03	ND	1.96E-08
Hexadecanoic Acid	1.10E-02	ND	2.32E-08
Octadecanoic Acid	ND	ND	1.05E-05
bis(2-ethylhexyl)Decanedioic Acid	ND	ND	ND
TO-13 (PAHs)	ND	ND	ND
naphthalene	1.02E-02	2.67E-04	1.19E-08
acenaphthylene	1.73E-03	1.78E-05	2.07E-09
acenaphthene	1.68E-04	8.02E-05	1.15E-10
fluorene	2.93E-04	7.66E-05	2.68E-10
phenanthrene	3.90E-04	1.32E-04	3.25E-10
anthracene	4.88E-05	1.78E-05	5.83E-11
fluoranthene	1.17E-04	3.39E-05	1.04E-10
pyrene	1.19E-04	3.21E-05	1.08E-10
benzo(a)anthracene	4.61E-05	3.21E-05	2.08E-11
chrysene	5.33E-05	2.14E-05	4.07E-11
benzo(b)fluoranthene	1.28E-04	3.92E-05	1.11E-10
benzo(k)fluoranthene	7.92E-05	1.96E-05	7.35E-11
benzo(a)pyrene	8.80E-05	2.32E-05	8.02E-11
indeno(1,2,3-cd)pyrene	1.15E-04	2.14E-05	1.15E-10
dibenz(a,h)anthracene	3.00E-05	2.14E-05	5.69E-12
benzo(g,h,i)perylene	2.00E-04	2.14E-05	2.16E-10
Dioxins/Furans			
2378-TCDD	3.26E-09	2.82E-09	ND
12378-PECDD	4.74E-09	4.32E-09	ND
123478-HXCDD	2.08E-09	1.74E-09	2.49E-15

Cartridge, 40-mm Target Practice, M781 (M203)		No. of rounds (t)	1 item
DODIC: B519		release duration (t):	2 seconds
Number of items per test firing => 14		Unit Concentration (UC):	2.03E-04 g/m <sup>3</sup>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item)	Average Modeled Concentration for One Item (grams/m <sup>3</sup> ) CONC
123678-HXCDD	2.04E-09	1.90E-09	ND
123789-HXCDD	5.36E-09	4.91E-09	ND
1234678-HPCDD	2.25E-08	3.38E-09	2.34E-14
OCDD	1.59E-07	1.95E-08	1.69E-13
2378-TCDF	2.71E-09	2.28E-09	ND
12378-PECDF	2.15E-09	1.99E-09	ND
23478-PECDF	9.48E-10	8.49E-10	ND
123478-HXCDF	2.65E-09	2.45E-09	ND
123678-HXCD	1.45E-09	1.34E-09	ND
123789-HXCDF	4.76E-09	4.52E-09	ND
234678-HXCDF	2.66E-09	2.41E-09	ND
1234678-HPCDF	2.62E-09	2.38E-09	ND
1234789-HPCDF	3.69E-09	3.80E-09	ND
OCDF	5.71E-09	5.23E-09	ND
<b>Energetics</b>			
Nitrobenzene	3.46E-03	3.45E-03	ND
2-Nitrotoluene	2.59E-01	3.45E-01	ND
3-Nitrotoluene	2.59E-01	3.45E-01	ND
4-Nitrotoluene	2.59E-01	3.45E-01	ND
Nitroglycerine	3.46E-03	3.45E-03	ND
1,3-Dinitrobenzene	3.46E-03	3.45E-03	ND
1,3,5-Trinitrobenzene	3.46E-03	3.45E-03	ND
2,4,6-Trinitrotoluene	3.46E-03	3.45E-03	ND
RDX	3.46E-03	3.45E-03	ND
4-Amino-2,6-Dinitrotoluene	3.46E-03	3.45E-03	ND
2-Amino-4,6-Dinitrotoluene	3.46E-03	3.45E-03	ND
Tetryl	3.46E-03	3.45E-03	ND

Cartridge, 40-mm Target Practice, M781 (M203)		No. of rounds (l):	1 item
DODIC: B519		release duration (t):	2 seconds
Number of items per test firing => 14		Unit Concentration (UC):	2.03E-04 g/m <sup>3</sup>
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Total Mass of Pollutant Emitted Per Item (grams) M
HMX	6.92E-03	6.90E-03	ND
Pentaerythritoltetranitrate	6.92E-03	6.90E-03	ND
Diphenylamine	8.65E-02	8.62E-02	ND
Footnotes:			ND

<sup>1</sup>ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emission Study Report)

NA = Not Applicable

ND = Not Detected

## **APPENDIX C**

### **HEALTH-BASED SCREENING LEVELS AND ACUTE TOXICITY VALUES**

Compound	CAS #	For the Chronic Evaluation (HBSSL)						For the Acute Evaluation (ATV)					
		Region 9 PRG* (ug/m <sup>3</sup> )	Toxicity Endpoint (C or nc)	RBC (ug/m <sup>3</sup> )	Region 3 Toxicity Endpoint (C or nc)	HBSL (ug/m <sup>3</sup> )	ERPGI (ug/m <sup>3</sup> )	STEEL (ug/m <sup>3</sup> )	AEGU (ug/m <sup>3</sup> )	Source (T or E)	ATV (ug/m <sup>3</sup> )		
<b>Permanent Gases</b>													
Ammonia (NH <sub>3</sub> )	7664-41-7	1.04E+02	nc	104.39	nc	1.04E+02	17500	1.75E+04	NA	E	1.75E+04		
Carbon Dioxide (CO <sub>2</sub> )	124-38-9	NA		NA		NA	NA	5.40E+07	NA	T	5.40E+07		
Carbon Monoxide (CO)	630-08-0	1.00E+04	nc	NA	NA	1.00E+04	2.30E+05	2.28E+05	NA	E	2.30E+05		
Oxides of Nitrogen (as NO)	10102-43-9	1.00E+02	nc	NA	NA	1.00E+02	3.08E+04	NA	NA	T	3.08E+04		
Methane (CH <sub>4</sub> )	74-82-8	NA		NA		NA	NA	9.90E+06	NA	T	9.90E+06		
Sulfur Dioxide (SO <sub>2</sub> )	7446-09-5	8.00E+01	nc	NA		8.00E+01	7.89E+02	7.86E+02	NA	E	7.89E+02		
<b>Acid Gases</b>													
Hydrogen fluoride	7664-39-3	NA		NA		NA	1.60E+03	1.64E+03	NA	E	1.60E+03		
Hydrogen chloride	7647-01-0	2.08E+01	nc	2.08E+01	nc	2.08E+01	4.50E+03	4.47E+03	NA	E	4.50E+03		
Hydrogen bromide	10035-10-6	NA		NA		NA	NA	9.93E+03	NA	T	9.93E+03		
Nitric Acid	7697-37-2	NA		NA		NA	NA	2.58E+03	1.30E+03	A	1.30E+03		
Phosphoric acid	7664-38-2	1.04E+01	nc	1.06E+01	nc	1.04E+01	NA	3.00E+03	NA	T	3.00E+03		
Sulfuric Acid	7664-93-9	NA		NA		NA	2.00E+03	2.00E+03	NA	E	2.00E+03		
<b>Cyanide</b>													
Particulate Cyanide	57-12-5	NA		7.30E+01	nc	7.30E+01	NA	5.00E+03	NA	T	5.00E+03		
Hydrogen Cyanide	74-90-8	3.13E+00	nc	3.14E+00	nc	3.13E+00	NA	5.17E+03	NA	T	5.17E+03		
<b>Particulates</b>													
TSP	12789-66-1	5.00E+01	nc	NA		5.00E+01	NA	NA	NA				
PM <sub>10</sub>		5.00E+01	nc	NA		5.00E+01	NA	NA	NA				
PM <sub>2.5</sub>		1.50E+01	nc	NA		1.50E+01	NA	NA	NA				
<b>Metals</b>													
Antimony	7440-36-0	NA		1.46E+00	nc	1.46E+00	NA	1.50E+03	NA	T	1.50E+03		
Arsenic	7440-38-2	4.47E-04	C	4.15E-04	C	4.47E-04	NA	3.00E+01	NA	T	3.00E+01		
Barium	7440-39-3	5.21E-01	nc	5.11E-01	nc	5.21E-01	NA	1.50E+03	NA	T	1.50E+03		
Beryllium	7440-41-7	8.00E-04	C	7.45E-04	C	8.00E-04	NA	5.00E+00	NA	T	5.00E+00		
Cadmium	7440-43-9	1.07E-03	C	9.94E-04	C	1.07E-03	NA	3.00E+01	NA	T	3.00E+01		
Chromium	7440-47-3	C	1.53E-04	C	1.53E-04	NA	1.50E+03	NA	NA	T	1.50E+03		
Cobalt	7440-48-4	NA		2.20E+02	nc	2.20E+02	NA	6.00E+01	NA	T	6.00E+01		
Copper	7440-50-8	NA		1.46E+02	nc	1.46E+02	NA	3.00E+03	NA	T	3.00E+03		
Lead	7439-92-1	1.50E+00	nc	NA		1.50E+00	NA	1.50E+02	NA	T	1.50E+02		
Manganese	7439-96-5	5.11E-02	nc	5.22E-02	nc	5.11E-02	NA	3.00E+03	NA	T	3.00E+03		
Nickel	7440-02-0	NA		7.30E+01	nc	7.30E+01	NA	3.00E+03	NA	T	3.00E+03		

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

Compound	CAS #	For the Chronic Evaluation (HBSSL)				For the Acute Evaluation (ATV)			
		Region 9 PRG ( $\mu\text{g}/\text{m}^3$ )	Toxicity Endpoint (C or nc)	Region 3 Toxicity RBC ( $\mu\text{g}/\text{m}^3$ )	Endpoint (C or nc)	HBSSL ( $\text{kg}/\text{m}^3$ )	TEEL ( $\text{kg}/\text{m}^3$ )	AEGL ( $\mu\text{g}/\text{m}^3$ )	Source (T or E) ATV <sub>X</sub> ( $\mu\text{g}/\text{m}^3$ )
Selenium	7782-49-2	NA	1.83E+01	nc	1.83E+01	NA	6.00E+02	NA	T 6.00E+02
Silver	7740-22-4	NA	1.83E+01	nc	1.83E+01	NA	3.00E+02	NA	T 3.00E+02
Thallium	7440-28-0	NA	2.56E-01	nc	2.56E-01	NA	3.00E+02	NA	T 3.00E+02
Zinc	7440-66-6	NA	1.10E+03	nc	1.10E+03	NA	3.00E+04	NA	T 3.00E+04
<b>TO-11 Carbonyls</b>									
Formaldehyde	50-00-0	1.48E-01	C	1.39E-01	C	1.48E-01	1.23E+03	NA	E 1.23E+03
Acetaldehyde	75-07-0	8.73E-01	C	8.13E-01	C	8.73E-01	1.80E+04	NA	E 1.80E+04
Acetone	67-64-1	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	2.37E+06	T 2.37E+06
Acrolein	107-02-8	2.09E-02	nc	2.08E-02	nc	2.09E-02	2.30E+02	NA	E 2.30E+02
Propionaldehyde	123-38-6	NA	NA	NA	NA	NA	7.50E+04	NA	T 7.50E+04
Crotonaldehyde	4170-30-3	3.54E-03	C	3.30E-03	C	3.54E-03	5.72E+03	NA	E 5.72E+03
Butyraldehyde	123-72-8	NA	NA	NA	NA	NA	7.38E+04	NA	T 7.38E+04
Benzaldehyde	100-52-7	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	1.50E+04	NA T 1.50E+04
Isovaleraldehyde	590-86-3	NA	NA	NA	NA	NA	NA	NA	NA
Valeraldehyde	110-62-3	NA	NA	NA	NA	NA	NA	NA	NA
o,m,p-Tritolyldehyde	1354-78-7	NA	NA	NA	NA	NA	NA	NA	NA
Hexaldehyde	66-25-1	NA	NA	NA	NA	NA	NA	NA	NA
2,5-Dimethylbenzaldehyde	5779-94-2	NA	NA	NA	NA	NA	NA	NA	NA
<b>VOCs</b>									
Propene	1115-07-1	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	75-71-8	2.09E+02	nc	1.83E+02	nc	2.09E+02	NA	1.48E+07	T 1.48E+07
Chlorodifluoromethane	75-45-6	5.11E+04	nc	5.11E+04	nc	5.11E+04	NA	4.41E+06	T 4.41E+06
Freon 114	76-14-2	NA	NA	NA	NA	NA	2.10E+07	NA	2.10E+07
Chloromethane	74-87-3	1.07E+00	C	1.79E+00	C	1.07E+00	NA	2.06E+05	T 2.06E+05
Vinyl Chloride	75-01-4	2.20E-02	C	2.10E-02	C	2.20E-02	NA	1.28E+04	T 1.28E+04
1,3-Butadiene	106-99-0	3.74E-03	C	3.48E-03	C	3.74E-03	2.20E+04	2.21E+04	E 2.20E+04
Bromomethane	74-83-9	5.21E+00	nc	5.11E+00	nc	5.21E+00	NA	5.82E+04	T 5.82E+04
Chloroethane	75-00-3	2.32E+00	nc	NA	NA	2.32E+00	NA	2.64E+06	T 2.64E+06
Dichlorofluoromethane	75-71-8	2.09E+02	nc	1.83E+02	nc	2.09E+02	NA	1.48E+07	T 1.48E+07
Trichlorofluoromethane	75-69-4	7.30E+02	nc	7.30E+02	nc	7.30E+02	NA	2.81E+06	T 2.81E+06
Pentane	109-66-0	NA	NA	NA	NA	NA	1.80E+06	NA	1.80E+06
Acrolein	107-02-8	2.09E-02	nc	2.08E-02	nc	2.09E-02	2.30E+02	2.29E+02	E 2.30E+02
1,1-Dichloroethene	75-35-4	5.21E+02	nc	5.11E+02	nc	5.21E+02	NA	7.92E+04	T 7.92E+04
Freon 113	76-13-1	3.13E+04	nc	3.14E+04	nc	3.13E+04	NA	9.58E+06	T 9.58E+06
Acetone	67-64-1	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	2.37E+06	T 2.37E+06

Compound	CAS #	Region 9 PRG ( $\mu\text{g}/\text{m}^3$ )	For the Chronic Evaluation (HBSL)			For the Acute Evaluation (ATV)		
			Toxicity Endpoint (c or nc)	Region 3 RBC ( $\mu\text{g}/\text{m}^3$ )	Toxicity Endpoint (c or nc)	HBSL ( $\mu\text{g}/\text{m}^3$ )	ERPG ( $\mu\text{g}/\text{m}^3$ )	ATV ( $\mu\text{g}/\text{m}^3$ )
Methyl Iodide	74-88-4	NA	NA	NA	NA	145000	1.45E+05	E 1.45E+05
Carbon Disulfide	75-15-0	7.30E+02	nc	7.30E+02	nc	7.30E+02	NA	3.11E+04 T 3.11E+04
Acetonitrile	75-05-8	6.20E+01	nc	6.21E+01	nc	6.20E+01	NA	1.01E+05 T 1.01E+05
3-Chloropropene	107-05-1	1.04E+00	nc	NA	NA	1.04E+00	9.39E+03	9.39E+03 E 9.39E+03
Methylene Chloride	75-09-2	4.09E+00	c	3.79E+00	c	4.09E+00	696000	6.94E+05 E 6.96E+05
tert-Butyl Alcohol	75-65-0	NA	NA	NA	NA	NA	NA	4.55E+05 T 4.55E+05
Acrylonitrile	107-13-1	2.83E-02	c	2.61E-02	c	2.83E-02	21700	2.17E+04 E 2.17E+04
trans-1,2-Dichloroethene	156-60-5	7.30E+01	nc	7.30E+01	nc	7.30E+01	NA	4.95E+04 T 4.95E+04
Methyl t-Butyl Ether	1634-04-4	3.13E+03	nc	3.13E+03	nc	3.13E+03	NA	4.32E+05 T 4.32E+05
Hexane	110-54-3	2.09E+02	nc	2.08E+02	nc	2.09E+02	NA	5.28E+05 T 5.28E+05
1,1-Dichloroethane	75-34-3	5.21E+02	nc	5.11E+02	nc	5.21E+02	NA	1.21E+06 T 1.21E+06
Vinyl Acetate	108-05-4	2.09E+02	nc	2.08E+02	nc	2.09E+02	19150	1.76E+04 E 1.92E+04
cis-1,2-Dichloroethene	156-59-2	3.65E+01	nc	3.65E+01	nc	3.65E+01	NA	7.92E+05 T 7.92E+05
2-Butanone	78-93-3	1.04E+03	nc	1.04E+03	nc	1.04E+03	NA	8.85E+05 T 8.85E+05
Ethyl Acetate	141-78-6	3.29E+03	nc	3.29E+03	nc	3.29E+03	NA	1.44E+06 T 1.44E+06
Methyl Acrylate	96-33-3	1.10E+02	nc	1.10E+02	nc	1.10E+02	NA	NA NA NA NA NA NA NA NA NA
Chloroform	67-66-3	8.35E-02	c	7.73E-02	c	8.35E-02	NA	9.76E+03 T 9.76E+03
1,1,1-Trichloroethane	71-55-6	1.04E+03	nc	2.30E+03	nc	1.04E+03	1.94E+06	1.91E+06 E 1.94E+06
Carbon Tetrachloride	56-23-5	1.28E-01	c	1.18E-01	c	1.28E-01	1.28E+05	1.26E+05 E 1.28E+05
1,2-Dichloroethane	107-06-2	7.39E-02	c	6.88E-02	c	7.39E-02	NA	8.08E+03 T 8.08E+03
Benzene	71-43-2	2.49E-01	c	2.16E-01	c	2.49E-01	1.56E+05	1.60E+05 E 1.56E+05
Isooctane (2,2,4-trimethylpentane)	540-84-1	NA	NA	NA	NA	NA	3.50E+05	T 3.50E+05
Heptane	142-82-5	NA	NA	NA	NA	NA	1.80E+06	T 1.80E+06
Trichloroethane	71-55-6	1.04E+03	nc	2.30E+03	nc	1.04E+03	1.94E+06	1.91E+06 E 1.94E+06
Ethyl Acrylate	140-88-5	1.40E-01	c	NA	1.40E-01	NA	6.14E+04	T 6.14E+04
1,2-Dichloropropane	78-87-5	9.89E-02	c	9.21E-02	c	9.89E-02	NA	5.08E+05 T 5.08E+05
Methyl Methacrylate	80-62-6	7.30E+02	nc	7.30E+02	nc	7.30E+02	NA	4.09E+05 T 4.09E+05
Dibromomethane	74-95-3	3.65E+01	nc	3.65E+01	nc	3.65E+01	NA	2.50E+05 T 2.50E+05
1,4-Dioxane	123-91-1	6.11E-01	c	5.69E-01	c	6.11E-01	NA	9.00E+04 T 9.00E+04
Bromodichloromethane	75-27-4	1.08E-01	c	1.01E-01	c	1.08E-01	NA	4.00E+03 T 4.00E+03
4-Methyl-2-Pentanone	108-10-1	8.34E+01	nc	7.30E+01	nc	8.34E+01	NA	3.07E+05 T 3.07E+05
Toluene	108-88-3	4.02E+02	nc	4.16E+02	nc	4.02E+02	1.89E+05	E 1.88E+05
Octane	111-65-9	NA	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	10061-02-6	5.17E-02	c	4.82E-02	c	5.17E-02	NA	NA
Ethyl Methacrylate	97-63-2	3.29E+02	nc	3.29E+02	nc	3.29E+02	NA	NA

**Appendix C: Health-Based Screening Levels and Acute Toxicity Values**

Compound	CAS #	For the Chronic Evaluation (HBSL)				For the Acute Evaluation (ATV)				
		Region 9 PRG ( $\mu\text{g}/\text{m}^3$ )	Toxicity Endpoint (C or nc)	Region 3 RBC ( $\mu\text{g}/\text{m}^3$ )	HBSU ( $\mu\text{g}/\text{m}^3$ )	ERPG ( $\mu\text{g}/\text{m}^3$ )	STEEL ( $\mu\text{g}/\text{m}^3$ )	AGEI ( $\mu\text{g}/\text{m}^3$ )	Source (T or E)	ATV ( $\mu\text{g}/\text{m}^3$ )
1,1,2-Trichloroethane	79-00-5	1.20E-01	C	1.12E-01	C	1.20E-01	NA	1.64E+05	T	1.64E+05
Tetrachloroethylene	127-18-4	3.31E+00	C	3.13E+00	C	3.31E+00	NA	6.78E+05	T	6.78E+05
2-Hexanone	591-78-6	NA		5.11E+00	nc	5.11E+00	NA	4.09E+04	T	4.09E+04
Dibromochloromethane	124-48-1	8.00E-02	C	7.45E-02	C	8.00E-02	NA	6.00E+03	T	6.00E+03
1,2-Dibromoethane	106-93-4	8.73E-03	C	8.24E-03	C	8.73E-03	NA	1.54E+05	T	1.54E+05
Chlorobenzene	108-90-7	6.21E+01	nc	6.21E+01	nc	6.21E+01	NA	1.38E+05	T	1.38E+05
1,1,1,2-Tetrachloroethane	630-20-6	2.60E-01	C	2.41E-01	C	2.60E-01	NA	5.15E+04	T	5.15E+04
Ethylbenzene	100-41-4	1.06E+03	nc	1.06E+03	nc	1.06E+03	NA	5.43E+05	T	5.43E+05
m&p-Xylene	106-42-3	7.30E+02	nc	7.30E+03	nc	7.30E+02	NA	6.51E+05	T	6.51E+05
o-Xylene	95-47-6	7.30E+02	nc	7.30E+03	nc	7.30E+02	NA	6.51E+05	T	6.51E+05
Syrene	100-42-5	1.06E+03	nc	1.04E+03	nc	1.06E+03	2.13E+05	NA	E	2.13E+05
Bromoform	75-25-2	1.75E+00	C	1.61E+00	C	1.75E+00	NA	6.20E+03	T	6.20E+03
Cumene	98-82-8	4.02E+02	nc	4.02E+02	nc	4.02E+02	NA	2.46E+05	T	2.46E+05
1,1,2,2-Tetrachloroethane	79-34-5	3.31E-02	C	3.13E-02	C	3.31E-02	NA	2.06E+04	T	2.06E+04
1,2,3-Trichloropropane	96-18-4	9.61E-04	C	3.13E-03	C	9.61E-04	NA	6.03E+04	T	6.03E+04
Bromobenzene	108-86-1	1.04E+01	nc	NA		1.04E+01	NA	4.82E+04	T	4.82E+04
4-Ethyltoluene	622-96-8	NA		NA		NA	NA	1.25E+05	T	1.25E+05
1,3,5-Trimethylbenzene	108-67-8	6.21E+00	nc	6.21E+00	nc	6.21E+00	NA	3.68E+05	T	3.68E+05
Alpha Methyl Styrene	98-83-9	2.56E+02	nc	2.56E+02	nc	2.56E+02	NA	NA	NA	NA
1,2,4-Trimethylbenzene	95-63-6	6.21E+00	nc	6.21E+00	nc	6.21E+00	NA	1.80E+05	T	1.80E+05
1,3-Dichlorobenzene	541-73-1	3.29E+00	nc	3.29E+00	nc	3.29E+00	NA	3.61E+04	T	3.61E+04
1,4-Dichlorobenzene	106-46-7	3.06E-01	C	2.85E-01	C	3.06E-01	NA	6.61E+05	T	6.61E+05
Benzyl Chloride	100-44-7	3.96E-02	C	3.68E-02	C	3.96E-02	5.20E+03	5.17E+03	E	5.20E+03
1,2-Dichlorobenzene	95-50-1	2.09E+02	nc	3.29E+01	nc	2.09E+02	NA	3.01E+05	T	3.01E+05
Hexachloroethane	67-72-1	4.80E-01	C	4.47E-01	C	4.80E-01	NA	2.90E+04	T	2.90E+04
1,2,4-Trichlorobenzene	120-82-1	2.08E+02	nc	2.08E+02	nc	2.08E+02	NA	3.71E+04	T	3.71E+04
Hexachlorobutadiene	87-68-3	8.73E-02	C	8.03E-02	C	8.73E-02	3.20E+04	NA	E	3.21E+04
<b>Hydrocarbons</b>										
Methane	74-82-8	NA		NA		NA	NA	3.30E+06	T	3.30E+06
Ethylene	74-85-1	NA		NA		NA	NA	4.60E+05	T	4.60E+05
Acetylene	74-86-2	NA		NA		NA	NA	NA	NA	NA
Ethane	74-84-0	NA		NA		NA	NA	NA	NA	NA
Propylene	111-07-1	NA		NA		NA	NA	NA	NA	NA
Propane	74-98-6	NA		NA		NA	NA	3.78E+06	T	3.78E+06
Propyne (methyl acetylene)	74-99-7	NA		NA		NA	NA	2.79E+06	T	2.79E+06

Compound	CAS #	For the Chronic Evaluation (HBSL)						For the Acute Evaluation (ATV)								
		Region 9 PRG Endpoint (μg/m <sup>3</sup> )	Region 9 RBC Endpoint (c or nc)	Toxicity Endpoint (μg/m <sup>3</sup> )	HBSL (ng/m <sup>3</sup> )	ERP (ng/m <sup>3</sup> )	EEI (ng/m <sup>3</sup> )	Source (T or E)	ATV (μg/m <sup>3</sup> )	Region 9 PRG Endpoint (μg/m <sup>3</sup> )	Region 9 RBC Endpoint (c or nc)	Toxicity Endpoint (μg/m <sup>3</sup> )	HBSL (ng/m <sup>3</sup> )	ERP (ng/m <sup>3</sup> )	EEI (ng/m <sup>3</sup> )	Source (T or E)
Isobutane	75-28-5	NA	NA	NA	NA	NA	NA	NA	9.52E+05	T	9.52E+05	NA	NA	NA	NA	NA
1-Butene/Isobutylene (115-11-7)	106-98-9	NA	NA	NA	NA	NA	NA	NA	6.87E+06	T	6.87E+06	NA	NA	NA	NA	NA
1,3-Butadiene	106-99-0	3.74E-03	c	3.48E-03	c	3.74E-03	2.20E+04	2.21E+04	E	2.20E+04	E	2.20E+04	NA	NA	NA	NA
Butane	106-97-8	NA	NA	NA	NA	NA	NA	NA	5.71E+06	T	5.71E+06	NA	NA	NA	NA	NA
1-Butyne/cis-Butene	107-00-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-Butene	25167-67-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butyne (crotonylene)	503-17-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Pentane	109-66-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Hexane	110-54-3	2.10E+02	nc	2.08E+02	nc	2.10E+02	nc	2.10E+02	NA	1.80E+06	T	1.80E+06	NA	NA	NA	NA
<b>VOC Tentatively Identified Compounds (TICs)</b>																
Propyne /1-Propyne	74-99-7	NA	NA	NA	NA	NA	NA	NA	NA	2.79E+06	T	2.79E+06	NA	NA	NA	NA
1-Chloro-1,1-difluoroethane	75-68-3	5.22E+04	nc	5.11E+04	nc	5.22E+04	NA	5.22E+04	NA	4.11E+07	T	4.11E+07	NA	NA	NA	NA
2-Methyl-1-propene (isobutene)	115-11-7	NA	NA	NA	NA	NA	NA	NA	NA	6.87E+06	T	6.87E+06	NA	NA	NA	NA
Acetaldehyde	75-07-0	8.73E-01	c	8.13E-01	c	8.73E-01	1.80E+04	1.80E+04	E	1.80E+04	E	1.80E+04	NA	NA	NA	NA
1-Buten-3-yne (vinyl acetylene)	689-97-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylcyclopropane	1191-96-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethanol	64-17-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Furan	110-00-9	3.65E+00	nc	NA	NA	3.65E+00	NA	3.65E+00	NA	1.67E+02	T	1.67E+02	NA	NA	NA	NA
1-Hexene	592-41-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thiirane (ethylene sulfide)	420-12-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thiophene	110-02-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,2,4-Trimethyl-1-pentene	61665-19-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Undecane	1120-21-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Methyl-undecane (dodecane)	112-40-3	NA	NA	NA	NA	NA	NA	NA	NA	6.39E+03	T	6.39E+03	NA	NA	NA	NA
Dodecane	112-40-3	NA	NA	NA	NA	NA	NA	NA	NA	3.48E+03	T	3.48E+03	NA	NA	NA	NA
2,6-Dimethyl-undecane	17301-23-4	NA	NA	NA	NA	NA	NA	NA	NA	3.48E+03	T	3.48E+03	NA	NA	NA	NA
<b>SVOCs</b>																
n-nitrosodimethylamine	62-75-9	1.37E-04	c	1.23E-04	c	1.37E-04	NA	2.50E+03	NA	2.50E+03	T	2.50E+03	NA	NA	NA	NA
bis(2-chloroethyl)ether	111-44-4	5.82E-03	c	5.69E-03	c	5.82E-03	NA	5.85E+04	NA	5.85E+04	T	5.85E+04	NA	NA	NA	NA
phenol	108-95-2	2.19E+03	nc	2.19E+03	nc	2.19E+03	NA	3.85E+04	NA	3.85E+04	T	3.85E+04	NA	NA	NA	NA
2-chlorophenol	95-57-8	1.83E+01	nc	1.83E+01	nc	1.83E+01	NA	5.25E+03	NA	5.25E+03	T	5.25E+03	NA	NA	NA	NA
1,3-Dichlorobenzene	541-73-1	3.29E+00	nc	3.29E+00	nc	3.29E+00	NA	3.61E+04	NA	3.61E+04	T	3.61E+04	NA	NA	NA	NA
1,4-dichlorobenzene	106-46-7	3.06E-01	c	2.85E-01	c	3.06E-01	NA	6.61E+05	NA	6.61E+05	T	6.61E+05	NA	NA	NA	NA
1,2-dichlorobenzene	95-50-1	2.09E+02	nc	3.29E+01	nc	2.09E+02	NA	3.01E+05	NA	3.01E+05	T	3.01E+05	NA	NA	NA	NA
benzyl alcohol	100-51-6	1.10E+03	nc	1.10E+03	nc	1.10E+03	NA	5.53E+04	NA	5.53E+04	T	5.53E+04	NA	NA	NA	NA

**Appendix C: Health-Based Screening Levels and Acute Toxicity Values**

Compound	CAS #	For the Chronic Evaluation (HBSC)				For the Acute Evaluation (ATV)					
		Region 9 PRG ( $\mu\text{g}/\text{m}^3$ )	Region 3 PRG ( $\mu\text{g}/\text{m}^3$ )	Toxicity Endpoint (C or nc)	Endpoint (C or nc) ( $\text{kg}/\text{m}^3$ )	HBSC ( $\text{kg}/\text{m}^3$ )	HBSC ( $\text{kg}/\text{m}^3$ )	ERPG ( $\text{kg}/\text{m}^3$ )	ERGL ( $\text{kg}/\text{m}^3$ )	Source (C or NC)	ATV ( $\text{kg}/\text{m}^3$ )
bis(2-chloroisopropyl)ether	108-60-1	1.92E-01	C	1.79E-01	c	1.92E-01	NA	6.98E+04	NA	T	6.98E+04
2-methylphenol	95-48-7	1.83E+02	nc	1.83E+02	nc	1.83E+02	NA	NA	NA	NA	NA
hexachloroethane	67-72-1	4.80E-01	C	4.47E-01	C	4.80E-01	NA	2.90E+04	NA	T	2.90E+04
n-nitroso-di-n-propylamine	621-64-7	9.61E-04	C	8.94E-04	C	9.61E-04	NA	2.00E+02	NA	T	2.00E+02
4-methylphenol	106-44-5	1.83E+02	nc	1.83E+02	nc	1.83E+02	NA	NA	NA	NA	NA
nitrobenzene	98-95-3	2.09E+00	nc	2.19E+00	nc	2.09E+00	NA	1.51E+04	NA	T	1.51E+04
isophorone	78-59-1	7.08E+00	C	6.59E+00	C	7.08E+00	NA	2.83E+04	NA	T	2.83E+04
2-nitrophenol	88-75-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-dimethylphenol	105-67-9	7.30E+01	nc	7.30E+01	nc	7.30E+01	NA	NA	NA	NA	NA
bis(2-chloroethoxy)methane	111-91-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-dichlorophenol	120-83-2	1.10E+01	nc	1.10E+01	nc	1.10E+01	NA	3.00E+04	NA	T	3.00E+04
Benzoic Acid	65-85-0	1.46E+04	nc	14600	nc	1.46E+04	NA	12500	NA	T	1.25E+04
1,2,4-trichlorobenzene	120-82-1	2.08E+02	nc	2.08E+02	nc	2.08E+02	NA	3.71E+04	NA	T	3.71E+04
naphthalene	91-20-3	3.13E+00	nc	3.29E+00	nc	3.13E+00	NA	7.86E+04	NA	T	7.86E+04
4-chloroaniline	106-47-8	1.46E+01	nc	1.46E+01	nc	1.46E+01	NA	3.00E+04	NA	T	3.00E+04
hexachlorobutadiene	87-68-3	8.62E-02	C	8.03E-02	C	8.62E-02	3.21E+04	3.20E+04	E	3.21E+04	E
4-chloro-3-methylphenol	59-50-7	NA	NA	NA	NA	NA	NA	2.00E+04	NA	T	2.00E+04
2-methylnaphthalene	91-57-6	NA	NA	7.30E+01	nc	7.30E+01	NA	2.00E+04	NA	T	2.00E+04
hexachlorocyclopentadiene	77-47-4	7.30E-02	nc	7.30E-02	nc	7.30E-02	NA	2.23E+02	NA	T	2.23E+02
2,4,6-trichlorophenol	88-06-2	1.10E+02	nc	1.10E+02	nc	1.10E+02	NA	3.00E+04	NA	T	3.00E+04
2,4,5-trichlorophenol	95-95-4	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	3.00E+04	NA	T	3.00E+04
2-chloronaphthalene	91-58-7	2.92E+02	nc	2.92E+02	nc	2.92E+02	NA	6.00E+02	NA	T	6.00E+02
2-nitroaniline	88-74-4	2.09E-01	nc	2.08E-01	nc	2.09E-01	NA	NA	NA	NA	NA
Acenaphthylene	208-96-8	NA	NA	NA	NA	NA	NA	2.00E+02	NA	T	2.00E+02
dimethylphthalate	131-11-3	3.65E-04	nc	3.65E-04	nc	3.65E-04	NA	1.50E+04	NA	T	1.50E+04
2,6-dinitrotoluene	606-20-2	3.65E+00	nc	3.65E+00	nc	3.65E+00	NA	6.00E+02	NA	T	6.00E+02
Acenaphthene	83-32-9	2.19E-02	nc	2.19E-02	nc	2.19E-02	NA	1.25E+03	NA	T	1.25E+03
3-nitroaniline	99-09-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-dinitrophenol	51-28-5	7.30E+00	nc	7.30E+00	nc	7.30E+00	NA	7.50E+03	NA	T	7.50E+03
dibenzofuran	132-64-9	1.46E+01	nc	1.46E+01	nc	1.46E+01	NA	NA	NA	NA	NA
2,4-dinitrotoluene	121-14-2	7.30E+00	nc	7.30E+00	nc	7.30E+00	NA	6.00E+02	NA	T	6.00E+02
4-nitrophenol	100-02-7	2.92E-01	nc	2.92E-01	nc	2.92E-01	NA	3.00E+04	NA	T	3.00E+04
Fluorene	86-73-7	1.46E-02	nc	1.46E-02	nc	1.46E-02	NA	7.50E+04	NA	T	7.50E+04
4-chlorophenyl-phenylether	7005-72-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
diethylphthalate	84-66-2	2.92E+03	nc	2.92E+03	nc	2.92E+03	NA	1.50E+04	NA	T	1.50E+04

OXICITY Values

Compound	CAS #	For the Chronic Evaluation (HBSL)						For the Acute Evaluation (ATV)					
		Region 9 PRG ( $\mu\text{g}/\text{m}^3$ )	Toxicity Endpoint (c or nc)	Region 3 RBC ( $\mu\text{g}/\text{m}^3$ )	Toxicity Endpoint (c or nc)	HBSL ( $\mu\text{g}/\text{m}^3$ )	ERPG ( $\mu\text{g}/\text{m}^3$ )	TEEL ( $\mu\text{g}/\text{m}^3$ )	AEGL ( $\mu\text{g}/\text{m}^3$ )	Source (T or E)	ATV ( $\mu\text{g}/\text{m}^3$ )		
4-nitroaniline	100-01-6	NA		NA		NA	NA	9.00E+03		T	9.00E+03		
4,6-dinitro-2-methylphenol	534-52-1	NA		3.65E-01	nc	3.65E-01	NA	5.00E+02		T	5.00E+02		
n-nitrosodiphenylamine(1)	86-30-6	1.37E+00	c	1.28E+00	c	1.37E+00	NA	NA					
4-bromophenyl-phenylether	101-55-3	NA		NA		NA	NA	NA					
hexachlorobenzene	118-74-1	4.18E-03	c	3.91E-03	c	4.18E-03	NA	7.50E+01		T	7.50E+01		
pentachlorophenol	87-86-5	5.60E-02	c	5.22E-02	c	5.60E-02	NA	1.50E+03		T	1.50E+03		
phenanthrene	85-01-8	NA		NA		NA	NA	2.00E+03		T	2.00E+03		
anthracene	120-12-7	1.10E+03	nc	1.10E+03	nc	1.10E+03	NA	6.00E+03		T	6.00E+03		
di-n-butylphthalate	84-74-2	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	1.50E+04		T	1.50E+04		
fluoranthene	206-44-0	1.46E+02	nc	1.46E+02	nc	1.46E+02	NA	3.00E+01		T	3.00E+01		
pyrene	129-00-0	1.10E+02	nc	1.10E+02	nc	1.10E+02	NA	1.10E+02		T	1.50E+04		
butylbenzylphthalate	85-68-7	7.30E+02	nc	7.30E+02	nc	7.30E+02	NA	5.00E+05		T	5.00E+05		
benzo(a)anthracene	56-55-3	2.17E-02	c	8.58E-03	c	2.17E-02	NA	6.00E+02		T	6.00E+02		
chrysene	218-01-9	2.17E+00	c	8.58E-01	c	2.17E+00	NA	2.00E+02		T	2.00E+02		
3,3-dichlorobenzidine	91-94-1	1.50E-02	c	1.39E-02	c	1.50E-02	NA	6.21E+03		T	6.21E+03		
bis(2-ethylhexyl)phthalate	117-81-7	4.80E-01	c	4.47E-01	c	4.80E-01	NA	1.00E+04		T	1.00E+04		
di-n-octylphthalate	117-84-0	7.30E+01	nc	7.30E+01	nc	7.30E+01	NA	1.50E+05		T	1.50E+05		
benzo(b)fluoranthene	205-99-2	2.17E-02	c	8.58E-03	c	2.17E-02	NA	NA					
benzo(k)fluoranthene	207-08-9	2.17E-01	c	8.58E-02	c	2.17E-01	NA	NA					
benzo(a)pyrene	50-32-8	2.17E-03	c	2.02E-03	c	2.17E-03	NA	7.50E+03		T	7.50E+03		
indeno(1,2,3-cd)pyrene	193-39-5	2.17E-02	c	8.58E-03	c	2.17E-02	NA	NA					
dibenz(a,h)anthracene	53-70-3	2.17E-03	c	8.58E-04	c	2.17E-03	NA	3.00E+04		T	3.00E+04		
benzo(g,h)perylene	191-24-2	NA		NA		NA	NA	3.00E+04		T	3.00E+04		
<b>SVOC Tentatively Identified Compounds (TICs)</b>													
Acetophenone	98-86-2	2.10E-02	nc	2.08E-02	nc	2.10E-02	NA	3.00E+04		T	3.00E+04		
Phenol (to be added to Form I)	108-95-2	2.19E+03	nc	2.19E+03	nc	2.19E+03	NA	3.85E+04		T	3.85E+04		
Benzonitrile	100-47-0	NA		NA		NA	NA	1.50E+04		T	1.50E+04		
Undecane	1120-21-4	NA		NA		NA	NA	6.39E+03		T	6.39E+03		
Dodecane	112-40-3	NA		NA		NA	NA	3.48E+03		T	3.48E+03		
Hexy-cyclohexane	4292-75-5	NA		NA		NA	NA	NA					
Dodecamethylcyclohexasiloxane	540-97-6	NA		NA		NA	NA	NA					
Dodecanoic Acid (Lauric Acid)	143-07-7	NA		NA		NA	NA	NA					
Hexadecanoic Acid (Palmitic Acid)	57-10-3	NA		NA		NA	NA	NA					
Octadecanoic Acid (Stearic Acid)	57-11-4	NA		NA		NA	NA	7.50E+02		T	7.50E+02		
bis(2-ethylhexyl) Decanedioic Acid	122-62-3	NA		NA		NA	NA	3.50E+04		T	3.50E+04		
bis(2-ethylhexyl) Decanedioic Acid	NA			NA		NA	NA	NA			NA		

**Appendix C: Health-Based Screening Levels and Acute Toxicity Values**

Compound	CAS #	For the Chronic Evaluation (HBSL)				For the Acute Evaluation (ATV)					
		Region 9 PRG ( $\mu\text{g/m}^3$ )	Toxicity Endpoint (c or nc)	Region 3 RHC ( $\mu\text{g/m}^3$ )	Toxicity Endpoint (c or nc)	HBSL ( $\mu\text{g/m}^3$ )	ERPG ( $\mu\text{g/m}^3$ )	TEEL ( $\mu\text{g/m}^3$ )	AEGL ( $\mu\text{g/m}$ )	Source (Ref.)	ATV ( $\mu\text{g/m}^3$ )
<b>TO-13 (PAHs)</b>											
naphthalene	91-20-3	3.13E+00	nc	3.29E+00	nc	3.13E+00	NA	7.86E+04	NA	T	7.86E+04
acenaphthylene	208-96-8	NA		NA		NA	NA	2.00E+02	NA	T	2.00E+02
acenaphthene	83-32-9	2.19E+02	nc	2.19E+02	nc	2.19E+02	NA	1.25E+03	NA	T	1.25E+03
fluorene	86-73-7	1.46E+02	nc	1.46E+02	nc	1.46E+02	NA	7.50E+04	NA	T	7.50E+04
phenanthrene	85-01-8	NA		NA		NA	NA	2.00E+03	NA	T	2.00E+03
anthracene	120-12-7	1.10E+03	nc	1.10E+03	nc	1.10E+03	NA	6.00E+03	NA	T	6.00E+03
fluoranthene	206-44-0	1.46E+02	nc	1.46E+02	nc	1.46E+02	NA	3.00E+01	NA	T	3.00E+01
pyrene	129-00-0	1.10E+02	nc	1.10E+02	nc	1.10E+02	NA	1.50E+04	NA	T	1.50E+04
benzo(a)anthracene	56-55-3	2.17E-02	c	8.58E-03	c	2.17E-02	NA	6.00E+02	NA	T	6.00E+02
chrysene	218-01-9	2.17E+00	c	8.58E-01	c	2.17E+00	NA	2.00E+02	NA	T	2.00E+02
benzo(b)fluoranthene	205-99-2	2.17E-02	c	8.58E-03	c	2.17E-02	NA	NA	NA	NA	NA
benzo(k)fluoranthene	207-08-9	2.17E-01	c	8.58E-02	c	2.17E-01	NA	NA	NA	NA	NA
benzo(a)pyrene	50-32-8	2.17E-03	c	2.02E-03	c	2.17E-03	NA	7.50E+03	NA	T	7.50E+03
indeno[1,2,3-cd]pyrene	193-39-5	2.17E-02	c	8.58E-03	c	2.17E-02	NA	NA	NA	NA	NA
dibenz(a,h)anthracene	53-70-3	2.17E-03	c	8.58E-04	c	2.17E-03	NA	3.00E+04	NA	T	3.00E+04
benzo(g,h,i)perylene	191-24-2	NA		NA		NA	NA	3.00E+04	NA	T	3.00E+04
<b>Dioxins/Furans</b>											
2378-Tetrachlorodibenzo-p-dioxin	1746-01-6	4.48E-08	c	4.17E-08	c	4.48E-08	NA	3.50E+00	NA	T	3.50E+00
12378-Pentachlorodibenzo-p-dioxin	40321-76-4	NA		NA		NA	NA	2.50E+00	NA	T	2.50E+00
123478-Hexachlorodibenzo-p-dioxin	39427-28-6	NA		NA		NA	NA	NA	NA	NA	NA
123678-Hexachlorodibenzo-p-dioxin	57653-85-7	NA		NA		NA	NA	1.50E+01	NA	T	1.50E+01
123799-Hexachlorodibenzo-p-dioxin	19408-74-3	1.48E-06	c	1.38E-06	c	1.48E-06	NA	NA	NA	NA	NA
1234678-Heptachlorodibenzo-p-dioxin	35822-46-9	NA		NA		NA	NA	NA	NA	NA	NA
OCDD	3268-87-9	NA		NA		NA	NA	1.50E+02	NA	T	1.50E+02
2378-Tetrachlorodibenzo-p-furan	51207-31-9	NA		NA		NA	NA	2.00E+00	NA	T	2.00E+00
12378-Pentachlorodibenzo-p-furan	57117-41-6	NA		NA		NA	NA	NA	NA	NA	NA
23478-Pentachlorodibenzo-o-furan	57117-31-4	NA		NA		NA	NA	7.50E-02	NA	T	7.50E-02
123478-Hexachlorodibenzo-p-furan	70638-26-9	NA		NA		NA	NA	7.50E+00	NA	T	7.50E+00
123678-Hexachlorodibenzo-p-furan	57117-44-9	NA		NA		NA	NA	2.50E+00	NA	T	2.50E+00
123799-Hexachlorodibenzo-p-furan	72918-21-9	NA		NA		NA	NA	NA	NA	NA	NA
234678-Hexachlorodibenzo-p-furan	60851-34-5	NA		NA		NA	NA	1.50E+00	NA	T	1.50E+00
1234678-Heptachlorodibenzo-p-furan	67562-39-4	NA		NA		NA	NA	NA	NA	NA	NA
1234799-Heptachlorodibenzo-p-furan	55673-89-7	NA		NA		NA	NA	NA	NA	NA	NA
OCDF	39001-02-0	NA		NA		NA	NA	3.00E+02	NA	T	3.00E+02

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Compound	CAS #	For the Chronic Evaluation (HBSL)				For the Acute Evaluation (ATV)				
		Region 9 PRC ( $\mu\text{g}/\text{m}^3$ )	Toxicity Endpoint (c or nc)	Region 3 RBC ( $\mu\text{g}/\text{m}^3$ )	Toxicity Endpoint (c or nc)	HBSL ( $\mu\text{g}/\text{m}^3$ )	ERP <sub>G</sub> ( $\mu\text{g}/\text{m}^3$ )	TEEL ( $\mu\text{g}/\text{m}^3$ )	AEGL ( $\mu\text{g}/\text{m}^3$ )	Source (T or E)
<b>Energetics</b>										
Nitrobenzene	98-95-3	2.09E+00	nc	2.19E+00	nc	2.09E+00	NA	1.51E+04		T
2-Nitrotoluene	88-72-2	3.65E+01	nc	3.65E+01	nc	3.65E+01	NA	NA		NA
3-Nitrotoluene	99-08-1	3.65E+01	nc	7.30E+01	nc	3.65E+01	NA	NA		NA
4-Nitrotoluene	99-99-0	3.65E+01	nc	3.65E+01	nc	3.65E+01	NA	3.37E+04		T
Nitroglycerine	55-63-0	4.80E-01	c	4.47E-01	c	4.80E-01	NA	NA		3.37E+04
1,3-Dinitrobenzene	99-65-0	3.65E-01	nc	3.65E-01	nc	3.65E-01	NA	3.00E+03		T
2,6-Dinitrotoluene	606-20-2	3.65E+00	nc	3.65E+00	nc	3.65E+00	NA	6.00E+02		T
2,5-Dinitrotoluene	619-15-8	3.65E+00	nc	3.65E+00	nc	3.65E+00	NA	6.00E+02		T
1,3,5-Trinitrobenzene	99-35-4	1.10E+02	nc	1.10E+02	nc	1.10E+02	NA	3.00E+04		T
2,4,6-Trinitrotoluene	118-96-7	2.24E-01	c	2.09E-01	c	2.24E-01	NA	2.50E+04		T
RDX	121-82-4	6.11E-02	c	5.69E-02	c	6.11E-02	NA	NA		2.50E+04
4-Amino-2,6-Dinitrotoluene	19406-51-0	NA	NA	NA	NA	NA	NA	6.00E+02		T
2-Amino-2,6-Dinitrotoluene	355572-78-2	NA	NA	NA	NA	NA	NA	1.50E+04		T
Tetryl	479-45-8	3.65E+01	nc	3.65E+01	nc	3.65E+01	NA	3.00E+04		T
HMX	2691-41-0	1.83E+02	nc	1.83E+02	nc	1.83E+02	NA	NA		NA
Pentaerythritol Tetra Nitrate	78-11-5	NA	NA	NA	NA	NA	NA	5.00E+01		T
Dibutyl Phthalate	84-74-2	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	1.50E+04		T
Diethyl Phthalate	117-81-7	4.80E-01	c	4.47E-01	c	4.80E-01	NA	1.00E+04		T
Diphenylamine	122-39-4	9.13E+01	nc	9.13E+01	nc	9.13E+01	NA	3.00E+04		T

Footnotes:

PRC: Preliminary Remediation Goals

c: Cancer

nc:non-cancer

RBC: Risk-Based Concentration

HBSL: Health-based Screening Level

(E) ERP<sub>G</sub>: Emergency Response Planning Guidelines

(T) TEEL: Temporary Emergency Exposure Limits

(A) AEGL: Acute Exposure Guideline Level

ATV: Acute Toxicity Value

NA: Not available

**APPENDIX D**

**RISK ASSESSMENT DATA**

M918 40mm TPT fired from the MK19 (DODIC B584)							
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute</sub> /ATV > 1?
<b>Permanent Gases</b>							
Ammonia (NH3)	3.10E-02	1.04E+02	2.97E-04	no	2.81E+00	1.75E+04	1.61E-04
Carbon Dioxide (CO2)	9.61E+00	NV		na	3.49E+03	5.40E+07	6.47E-05
Carbon Monoxide (CO)	9.25E+00	1.00E+04	9.25E-04	no	8.40E+02	2.30E+05	3.65E-03
Oxides of Nitrogen (as NO)	2.27E-01	1.00E+02	2.27E-03	no	8.26E+01	3.08E+04	2.69E-03
Sulfur Dioxide (SO2)	NA	8.00E+01	na	NA	7.89E+02		na
<b>Acid Gases</b>							
Hydrogen fluoride	NA	NV		na	NA	1.60E+03	na
Hydrogen chloride	2.36E-03	2.08E+01	1.13E-04	no	2.14E-01	4.50E+03	4.76E-05
Hydrogen bromide	NA	NV		na	NA	9.93E+03	na
Nitric Acid	5.22E-03	NV		na	4.74E-01	1.30E+03	3.64E-04
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03	na
Sulfuric Acid	NA	NV		na	NA	2.00E+03	na
<b>Cyanide</b>							
Particulate Cyanide	1.18E-03	7.30E+01	1.61E-05	no	4.28E-01	5.00E+03	8.56E-05
Hydrogen Cyanide	4.80E-03	3.13E+00	1.54E-03	no	1.75E+00	5.17E+03	3.38E-04
<b>Particulates</b>							
TSP	5.11E-01	5.00E+01	1.02E-02	no	4.64E+01	NA	na
PM10	5.03E-01	5.00E+01	1.01E-02	no	4.57E+01	NA	na
PM2.5	4.17E-01	1.50E+01	2.78E-02	no	3.79E+01	NA	na
<b>Metals</b>							
Antimony	4.54E-09	1.46E+00	3.11E-09	no	1.65E+00	1.50E+03	1.10E-03
Arsenic	4.30E-12	4.47E-04	9.61E-09	no	3.64E-03	3.00E+01	1.21E-04
Barium	5.71E-08	5.21E-01	1.10E-07	no	2.07E+01	1.50E+03	1.38E-02
Beryllium	NA	8.00E-04		na	NA	5.00E+00	na
Cadmium	NA	1.07E-03		na	NA	3.00E+01	na
Chromium	3.94E-11	1.53E-04	2.58E-07	no	1.43E-02	1.50E+03	9.53E-06
Cobalt	1.13E-11	2.20E+02	5.15E-14	no	4.12E-03	6.00E+01	6.86E-05
Copper	9.09E-08	1.46E+02	6.23E-10	no	3.30E+01	3.00E+03	1.10E-02
Lead	4.10E-08	1.50E+00	2.74E-08	no	1.49E+01	1.50E+02	9.94E-02

Table D-1: Comparison of Air Concentrations With Health-Based Values for the M918

M918 40mm TPT fired from the MK19 (DODIC B584)							
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic/</sub> HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute/</sub> ATV > 1?
Manganese	7.38E-11	5.11E-02	1.44E-09	no	2.68E-02	3.00E+03	8.93E-06
Nickel	2.10E-10	7.30E+01	2.88E-12	no	7.64E-02	3.00E+03	2.55E-05
Selenium	NA	1.83E+01	na	NA	6.00E+02		na
Silver	2.66E-12	1.83E+01	1.46E-13	no	9.67E-04	3.00E+02	3.22E-06
Thallium	NA	2.56E-01	na	NA	3.00E+02		na
Zinc	6.89E-09	1.10E+03	6.29E-12	no	2.50E+00	3.00E+04	8.34E-05
<b>TO-11 Carbonyls</b>							
Formaldehyde	4.20E-10	1.48E-01	6.64E-09	no	8.91E-02	1.23E+03	7.24E-05
Acetaldehyde	1.54E-10	8.73E-01	4.12E-10	no	3.27E-02	1.80E+04	1.82E-06
Acetone	NA	3.65E+02	na	NA	2.37E+06		na
Propionaldehyde	NA	NV	na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03	na	NA	5.72E+03		na
Butyraldehyde	NA	NV	na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02	na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV	na	NA	NA		na
Valeraldehyde	NA	NV	na	NA	NA		na
o,m,p-Toluialdehyde	NA	NV	na	NA	NA		na
Hexaldehyde	NA	NV	na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV	na	NA	NA		na
<b>VOCs</b>							
Propane	1.37E-09	NV	na	1.25E-01	NA		na
Dichlorodifluoromethane	1.48E-11	2.09E+02	7.09E-14	no	5.37E-03	1.48E+07	3.62E-10
Chlorodifluoromethane	2.35E-11	5.11E+04	4.60E-16	no	8.54E-03	4.41E+06	1.93E-09
Freon 114	NA	NV	na	NA	2.10E+07		na
Chloromethane	4.12E-12	1.07E+00	9.00E-12	no	3.49E-03	2.06E+05	1.69E-08
Vinyl Chloride	5.46E-12	2.20E-02	5.79E-10	no	4.63E-03	1.28E+04	3.63E-07
1,3-Butadiene	9.46E-12	3.74E-03	5.91E-09	no	2.00E-03	2.20E+04	9.11E-08
Bromomethane	NA	5.21E+00	na	NA	5.82E+04		na
Chloroethane	NA	2.32E+00	na	NA	2.64E+06		na
Dichlorodifluoromethane	NA	2.09E+02	na	NA	1.48E+07		na

**M918 40mm TPT fired from the MK19 (DODIC B584)**

Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic/</sub> HBSSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute/</sub> ATV > 1?
Trichlorofluoromethane	1.12E-11	7.30E+02	1.53E-14	no	4.07E-03	2.81E+06	1.45E-09
Acrolein	1.55E-09	2.09E-02	7.41E-08	no	1.40E-01	2.30E+02	6.11E-04
1,1-Dichloroethene	NA	5.21E+02	na	na	7.92E+04		na
Freon 113	NA	3.13E+04	na	na	9.58E+06		na
Methyl Iodide	NA	NV	na	na	1.45E+05		na
Carbon Disulfide	1.45E-11	7.30E+02	1.98E-14	no	5.26E-03	3.11E+04	1.69E-07
Acetonitrile	5.49E-10	6.20E+01	8.86E-12	no	1.99E-01	1.01E+05	1.98E-06
3-Chloropropene	NA	1.04E+00	na	na	9.39E+03		na
Methylene Chloride	2.43E-10	4.09E+00	1.39E-10	no	5.15E-02	6.96E+05	7.40E-08
tert-Butyl Alcohol	2.61E-10	NV	na	na	9.50E-02	4.55E+05	2.09E-07
Acrylonitrile	2.90E-10	2.83E-02	2.40E-08	no	6.16E-02	2.17E+04	2.84E-06
trans-1,2-Dichloroethene	NA	7.30E+01	na	na	4.95E+04		na
Methyl t-Butyl Ether	NA	3.13E+03	na	na	4.32E+05		na
Hexane	NA	2.09E+02	na	na	5.28E+05		na
1,1-Dichloroethane	NA	5.21E+02	na	na	1.21E+06		na
Vinyl Acetate	NA	2.09E+02	na	na	1.92E+04		na
cis-1,2-Dichloroethene	NA	3.65E+01	na	na	7.92E+05		na
2-Butanone	2.94E-11	1.04E+03	2.82E-14	no	1.07E-02	8.85E+05	1.21E-08
Ethyl Acetate	NA	3.29E+03	na	na	1.44E+06		na
Methyl Acrylate	NA	1.10E+02	na	na	NA		na
Chloroform	NA	8.35E-02	na	na	9.76E+03		na
1,1,1-Trichloroethane	NA	1.04E+03	na	na	1.94E+06		na
Carbon Tetrachloride	NA	1.28E-01	na	na	1.28E+05		na
1,2-Dichloroethane	2.88E-11	7.39E-02	9.10E-10	no	2.44E-02	8.08E+03	3.02E-06
Benzene	1.36E-09	2.49E-01	1.28E-08	no	2.89E-01	1.56E+05	1.85E-06
Isooctane (2,2,4-trimethylpentane)	NA	NV	na	na	3.50E+05		na
Heptane	4.08E-11	NV	na	1.48E-02	1.80E+06	8.22E-09	no
Trichloroethane	NA	1.04E+03	na	na	1.94E+06		na
Ethyl Acrylate	NA	1.40E-01	na	na	6.14E+04		na
1,2-Dichloropropane	NA	9.89E-02	na	na	5.08E+05		na

Table D-1: Comparison of Air Concentrations With Health-Based Values for the M918

M918 40mm TPT fired from the MK19 (DODIC B584)							
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic/</sub> HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute/</sub> ATV > 1?
Methyl Methacrylate	NA	7.30E+02		na	NA	4.09E+05	na
Dibromomethane	NA	3.65E+01		na	NA	2.50E+05	na
1,4-Dioxane	NA	6.11E-01		na	NA	9.00E+04	na
Bromodichloromethane	NA	1.08E-01		na	NA	4.00E+03	na
4-Methyl-2-Pentanone	NA	8.34E+01		na	NA	3.07E+05	na
Toluene	5.01E-10	4.02E+02	1.25E-12	no	4.55E-02	1.88E+05	2.43E-07
Octane	NA	NV		na	NA	NA	na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA	na
Ethyl Methacrylate	NA	3.29E+02		na	NA	NA	na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05	na
Tetrachloroethene	1.16E-11	3.31E+00	8.17E-12	no	9.83E-03	6.78E+05	1.45E-08
2-Hexanone	2.72E-11	5.11E+00	5.33E-12	no	9.89E-03	4.09E+04	2.42E-07
Dibromochloromethane	NA	8.00E-02		na	NA	6.00E+03	na
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05	na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05	na
1,1,1,2-Tetrachloroethane	NA	2.60E-01		na	NA	5.15E+04	na
Ethylbenzene	7.54E-11	1.06E+03	7.12E-14	no	2.74E-02	5.43E+05	5.05E-08
m&p-Xylene	1.32E-10	7.30E+02	1.80E-13	no	4.78E-02	6.51E+05	7.34E-08
o-Xylene	7.06E-11	7.30E+02	9.68E-14	no	2.57E-02	6.51E+05	3.94E-08
Styrene	8.50E-11	1.06E+03	8.03E-14	no	7.72E-03	2.13E+05	3.62E-08
Bromoform	NA	1.75E+00		na	NA	6.20E+03	na
Cumene	1.96E-11	4.02E+02	4.89E-14	no	7.13E-03	2.46E+05	2.90E-08
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04	na
1,2,3-Trichloropropane	NA	9.61E-04		na	NA	6.03E+04	na
Bromobenzene	NA	1.04E+01		na	NA	4.82E+04	na
4-Ethyltoluene	1.96E-11	NV		na	7.12E-03	1.25E+05	5.69E-08
1,3,5-Trimethylbenzene	1.47E-11	6.21E+00	2.37E-12	no	5.34E-03	3.68E+05	1.45E-08
Alpha Methyl Styrene	NA	2.56E+02		na	NA	NA	na
1,2,4-Trimethylbenzene	3.27E-11	6.21E+00	5.26E-12	no	1.19E-02	1.80E+05	6.59E-08
1,3-Dichlorobenzene	NA	3.29E+00		na	NA	3.67E+04	na

### M918 40min TPT fired from the Mk19 (DODIC B584)

Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute</sub> / ATv	> 1?
1,4-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
1,2-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
Hexachloroethane	NA	4.80E-01		na	NA	2.90E+04		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.73E-02		na	NA	3.21E+04		na
<b>Hydrocarbons</b>								
Methane	3.13E-08	NV		na	1.14E+01	3.30E+06	3.44E-06	no
Ethylene	1.26E-08	NV		na	4.56E+00	4.60E+05	9.92E-06	no
Acetylene	6.22E-09	NV		na	5.65E-01	NA		na
Ethane	1.59E-09	NV		na	1.44E-01	NA		na
Propane	5.11E-10	NV		na	1.86E-01	3.78E+06	4.91E-08	no
Propyne (methyl acetylene)	NA	NV		na	NA	2.79E+06		na
Isobutane	NA	NV		na	NA	9.52E+05		na
1-Butene/isobutylene (115-11-7)	3.96E-09	NV		na	1.44E+00	6.87E+06	2.09E-07	no
Butane	NA	NV		na	NA	5.71E+06		na
1-Butyne/cis-Butene	NA	NV		na	NA	NA		na
trans-Butene	NA	NV		na	NA	NA		na
2-Butyne (crotonylen)	NA	NV		na	NA	NA		na
n-Pentane	3.91E-10	NV		na	1.42E-01	1.80E+06	7.90E-08	no
<b>C Tentatively Identified Compounds (TICs)</b>								
Propyne /1-Propyne	2.50E-10	NV		na	9.10E-02	2.79E+06	3.26E-08	no
1-Chloro-1,1-difluoroethane	2.05E-10	5.22E+04	3.93E-15	no	7.44E-02	4.11E+07	1.81E-09	no
2-Methyl-1-propene (Isobutene)	1.61E-09	NV		na	5.87E-01	6.87E+06	8.54E-08	no
Acetaldehyde	1.08E-10	8.73E-01	2.88E-10	no	2.28E-02	1.80E+04	1.27E-06	no
1-Buten-3-yne (vinyl acetylene)	7.78E-11	NV		na	7.07E-03	NA		na
Ethylcyclopropane	1.43E-10	NV		na	1.30E-02	NA		na
Ethanol	NA	NV		na	NA	5.64E+06		na
Furan	1.39E-10	3.65E+00	3.80E-11	no	5.04E-02	1.67E+02	3.02E-04	no
1-Hexene	2.06E-10	NV		na	1.87E-02	NA		na

Table D-1: Comparison of Air Concentrations With Health-Based Values for the M918

M918 40mm TPT fired from the MK19 (DODIC B584)						
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HB <sub>SL</sub>	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )
Thiirane (ethylene sulfide)	NA	NV		na	NA	NA
Thiophene	NA	NV		na	NA	na
2,2,4-Trimethyl-1-pentene	5.03E-10	NV		na	4.57E-02	NA
Undecane	NA	NV		na	NA	6.39E+03
3-Methyl-undecane (dodecane)	NA	NV		na	NA	3.48E+03
Dodecane	NA	NV		na	NA	3.48E+03
2,6-Dimethyl-undecane	NA	NV		na	NA	3.48E+03
<b>SVOCs</b>						
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04
phenol	NA	2.19E+03		na	NA	3.85E+04
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03
1,3-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04
2-methylphenol	NA	1.83E+02		na	NA	NA
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02
4-methylphenol	NA	1.83E+02		na	NA	NA
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04
isophorone	NA	7.08E+00		na	NA	2.83E+04
2-nitrophenol	NA	NV		na	NA	NA
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04
Benzoic Acid	2.67E-10	1.46E+04	1.83E-14	no	9.70E-02	1.25E+04
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04

**M918 40mm TPT fired from the MK19 (DODIC B584)**

Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HSIL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute</sub> / ATV	C <sub>acute</sub> / ATV > 1?
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04		na
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04		na
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02		na
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	3.00E+04		na
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04		na
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02		na
2-nitroaniline	NA	2.09E-01		na	NA	NA		na
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04		na
2,6-dinitrotoluene	NA	3.66E+00		na	NA	6.00E+02		na
3-nitroaniline	NA	NV		na	NA	NA		na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03		na
dibenzofuran	NA	1.46E+01		na	NA	NA		na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04		na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA		na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04		na
4-nitroaniline	NA	NV		na	NA	9.00E+03		na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02		na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA		na
4-bromophenyl-phenylether	NA	NV		na	NA	NA		na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01		na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03		na
di-n-butylphthalate	NA	3.65E+02		na	NA	1.50E+04		na
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05		na
3,3-dichlorobenzidine	NA	1.50E-02		na	NA	6.21E+03		na
bis(2-ethylhexyl)phthalate	5.53E-11	4.80E-01	2.69E-10	no	4.69E-02	1.00E+04	4.69E-06	no
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05		na
<b>SVOC Tentatively Identified Compounds (7/ICs)</b>								
Acetophenone	NA	2.10E-02		na	NA	3.00E+04		na

Table D-1: Comparison of Air Concentrations With Health-Based Values for the M918

M918 40mm TPT fired from the MK19 (DODIC B584)						
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )
Phenol (to be added to Form I)	NA	2.19E+03		na	NA	3.85E+04
Benzonitrile	NA	NV		na	NA	1.50E+04
Undecane	NA	NV		na	NA	6.39E+03
Dodecane	NA	NV		na	NA	3.48E+03
Hexyl-cyclohexane	NA	NV		na	NA	NA
Dodecamethylcyclohexasiloxane	1.64E-10	NV		na	1.49E-02	NA
Dodecanoic Acid (Lauric Acid)	NA	NV		na	NA	NA
Hexadecanoic Acid (Palmitic Acid)	1.85E-10	NV		na	6.73E-02	7.50E+02
Octadecanoic Acid (Stearic Acid)	1.86E-10	NV		na	6.77E-02	3.50E+04
bis(2-ethylhexyl) Decanedioic Acid	5.32E-09	NV		na	4.84E-01	NA
<b>TO-13 (PAHs)</b>						
naphthalene	8.08E-11	3.13E+00	2.58E-11	no	2.94E-02	7.86E+04
acenaphthylene	1.19E-11	NV		na	4.33E-03	3.74E-07
acenaphthene	9.08E-13	2.19E+02	4.15E-15	no	3.30E-04	2.00E+02
fluorene	2.28E-12	1.46E+02	1.56E-14	no	8.28E-04	1.25E+03
phenanthrene	2.84E-12	NV		na	1.03E-03	2.64E-07
anthracene	4.95E-13	1.10E+03	4.52E-16	no	1.80E-04	1.10E-08
fluoranthene	1.95E-12	1.46E+02	1.34E-14	no	7.09E-04	5.16E-07
pyrene	4.09E-12	1.10E+02	3.73E-14	no	3.00E-01	3.00E-08
benzo(a)anthracene	3.83E-13	2.17E-02	4.12E-11	no	6.00E+03	2.36E-05
chrysene	1.86E-13	2.17E+00	2.00E-13	no	1.58E-04	9.90E-08
benzo(b)fluoranthene	2.15E-13	2.17E-02	2.32E-11	no	4.56E-05	5.41E-07
benzo(k)fluoranthene	4.59E-13	2.17E-01	4.94E-12	no	9.74E-05	7.90E-07
benzo(a)pyrene	4.95E-13	2.17E-03	5.32E-10	no	4.19E-04	5.59E-08
Indeno(1,2,3-cd)pyrene	3.92E-13	2.17E-02	4.22E-11	no	8.32E-05	NA
dibenz(a,h)anthracene	5.00E-14	2.17E-03	5.38E-11	no	4.24E-05	1.41E-09
benzo(g,h,i)perylene	2.98E-12	NV		na	1.08E-03	3.61E-08
<b>Dioxins/Furans</b>						
2378-Tetrachlorodibenzo-p-dioxin	NA	4.48E-08		na	NA	3.50E+00
12378-Pentachlorodibenzo-p-dioxin	NA	NV		na	NA	2.50E+00

M918 40mm TPT fired from the MK19 (DODIC B584)						
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )
123478-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	NA
123678-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	1.50E+01
123789-Hexachlorodibenzo-p-dioxin	NA	1.48E-06		na	NA	na
1234678-Heptachlorodibenzo-p-dioxin	2.93E-17	NV		na	2.67E-09	NA
OCDD	2.61E-16	NV		na	9.50E-08	1.50E+02
2378-Tetrachlorodibenzo-p-furan	NA	NV		na	NA	6.33E-10
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	no
23478-Fentachlorodibenzo-p-furan	NA	NV		na	NA	na
123478-Hexachlorodibenzo-p-furan	NA	NV		na	NA	na
123678-Hexachlorodibenzo-p-furan	4.92E-18	NV		na	NA	7.50E-02
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	7.50E+00
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	7.15E-10
1234678-Heptachlorodibenzo-p-furan	6.59E-18	NV		na	NA	1.50E+00
1234789-Heptachlorodibenzo-p-furan	NA	NV		na	NA	na
OCDF	8.96E-18	NV		na	NA	na
<b>Energetics</b>						
Nitrobenzene	NA	2.09E+00		na	NA	1.51E+04
2-Nitrotoluene	NA	3.65E+01		na	NA	na
3-Nitrotoluene	NA	3.65E+01		na	NA	na
4-Nitrotoluene	NA	3.65E+01		na	NA	na
Nitroglycerine	NA	4.80E-01		na	NA	3.37E+04
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+03
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	3.00E+04
RDX	NA	6.11E-02		na	NA	2.50E+04
4-Amino-2,6-Dinitrotoluene	NA	NV		na	NA	na
2-Amino-2,6-Dinitrotoluene	NA	NV		na	NA	na
Tetryl	NA	3.65E+01		na	NA	1.50E+04
HMX	NA	1.83E+02		na	NA	na
Pentaerythritoltetranitrate	NA	NV		na	NA	5.00E+01

Table D-1: Comparison of Air Concentrations With Health-Based Values for the M918

M918 40mm TPT fired from the MK19 (DODIC B584)						
Compound	$C_{\text{chronic}}$ ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	$C_{\text{chronic}}/\text{HBSL}$	$> 1?$	$C_{\text{acute}}$ ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04
						na

Footnotes:

NA: Not applicable because compound was not detected.  
 na: Not available because health-based screening value is not available or not applicable if compound was not detected.  
 NV: No value available.  
 $C_{\text{chronic}}$ : Chronic time-averaged concentration  
 HBSL: Chronic health-based screening level  
 $C_{\text{acute}}$ : acute concentration  
 ATV: Acute toxicity value

Table 5-2. Comparison of Air Concentrations With Health-Based Values for the M918: Total Petroleum Hydrocarbons

M918 40mm TPT fired from the MK19 (DODIC B584)					
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )				
					Aromatic:C>8
Benzene	NA	NA	NA	3.18E-09	NA
Heptane	4.08E-11	NA	NA	NA	NA
Toluene	NA	NA	NA	5.01E-10	NA
Ethylbenzene	NA	NA	NA	7.54E-11	NA
m&p-Xylene	NA	NA	NA	1.32E-10	NA
o-Xylene	NA	NA	NA	7.06E-11	NA
Styrene	NA	NA	NA	NA	NA
Cumene	NA	NA	NA	NA	8.50E-11
4-Ethyltoluene	NA	NA	NA	NA	1.96E-11
1,3,5-Trimethylbenzene	NA	NA	NA	NA	1.96E-11
1,2,4-Trimethylbenzene	NA	NA	NA	NA	1.47E-11
Propane	5.11E-10	NA	NA	NA	3.27E-11
1-Butene/isobutylene (115-11-7)	3.96E-09	NA	NA	NA	NA
n-Pentane	3.91E-10	NA	NA	NA	NA
Propyne /1-Propyne	2.50E-10	NA	NA	NA	NA
Ethylcyclopropane	1.43E-10	NA	NA	NA	NA
1-Hexene	2.06E-10	NA	NA	NA	NA
2,2,4-Trimethyl-1-pentene	5.03E-10	NA	NA	NA	NA
naphthalene	NA	NA	NA	NA	NA
acenaphthylene	NA	NA	NA	NA	8.08E-11
acenaphthene	NA	NA	NA	NA	1.19E-11
fluorene	NA	NA	NA	NA	9.08E-13
phenanthrene	NA	NA	NA	NA	2.28E-12
anthracene	NA	NA	NA	NA	2.84E-12
fluoranthene	NA	NA	NA	NA	4.96E-13
Total ( $\mu\text{g}/\text{m}^3$ )	6.00E-09	0.00E+00	3.96E-09	2.73E-10	
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02	
C <sub>chronic</sub> /HBSL	3.13E-13	0.00E+00	9.50E-12	1.31E-12	

Table D-2: Comparison of Air Concentrations With Health-Based Values for the M918: Total Petroleum Hydrocarbons

M918 40mm TPT fired from the MK19 (DODIC B584)				
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )			
	Aliphatic:C<=8	Aliphatic:C>8	Aromatic:C<=8	Aromatic:C>8
>1?	no	no	no	no

Footnotes:

>1? = Is the ratio greater than one?  
NA = Not Applicable because compound was not detected  
C<sub>chronic</sub> = chronic averaged air Concentration  
HBSL = Health-Based Screening Level

**M781 40mm TPT fired from the M203 (DODIC B519)**

Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL > 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute</sub> / ATv > 1?
<b>Permanent Gases</b>						
Ammonia (NH <sub>3</sub> )	NA	1.04E+02		na	NA	1.75E+04
Carbon Dioxide (CO <sub>2</sub> )	1.14E+00	NV		na	3.72E+02	5.40E+07
Carbon Monoxide (CO)	1.57E+00	1.00E+04	1.57E-04	no	1.28E+02	2.30E+05
Oxides of Nitrogen (as NO)	1.05E-01	1.00E+02	1.05E-03	no	3.43E+01	3.08E+04
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02
<b>Acid Gases</b>						
Hydrogen fluoride	NA	NV		na	NA	1.60E+03
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03
Hydrogen bromide	NA	NV		na	NA	9.93E+03
Nitric Acid	1.24E-03	NV		na	1.01E-01	1.30E+03
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03
Sulfuric Acid	NA	NV		na	NA	2.00E+03
<b>Cyanide</b>						
Particulate Cyanide	NA	7.30E+01		na	NA	5.00E+03
Hydrogen Cyanide	2.69E-03	3.13E+00	8.61E-04	no	8.78E-01	5.17E+03
<b>Particulates</b>						
TSP	1.54E-01	5.00E+01	3.08E-03	no	1.25E+01	NA
PM10	1.74E-01	5.00E+01	3.47E-03	no	1.41E+01	NA
PM2.5	1.54E-01	1.50E+01	1.03E-02	no	1.26E+01	NA
<b>Metals</b>						
Antimony	5.44E-09	1.46E+00	3.73E-09	no	1.77E+00	1.50E+03
Arsenic	NA	4.47E-04		na	NA	3.00E+01
Barium	2.92E-09	5.21E-01	5.61E-09	no	9.53E-01	1.50E+03
Beryllium	NA	8.00E-04		na	NA	5.00E+00
Cadmium	NA	1.07E-03		na	NA	3.00E+01
Chromium	6.48E-11	1.53E-04	4.25E-07	no	2.11E-02	1.50E+03
Cobalt	NA	2.20E+02		na	NA	6.00E+01
Copper	3.18E-10	1.46E+02	2.18E-12	no	1.04E-01	3.00E+03
Lead	2.94E-08	1.50E+00	1.96E-08	no	9.56E+00	1.50E+02

Table D-3: Comparison of Air Concentrations With Health-Based Values for the M781

M781 40mm TPT fired from the M203 (DODIC B519)								
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute</sub> / ATv	> 1?
Manganese	5.02E-12	5.11E-02	9.82E-11	no	1.63E-03	3.00E+03	5.45E-07	no
Nickel	NA	7.30E+01	na	NA	3.00E+03		na	
Selenium	NA	1.83E+01	na	NA	6.00E+02		na	
Silver	NA	1.83E+01	na	NA	3.00E+02		na	
Thallium	NA	2.56E-01	na	NA	3.00E+02		na	
Zinc	1.83E-08	1.10E+03	1.68E-11	no	5.98E+00	3.00E+04	1.99E-04	no
<b>TO-11 Carbonyls</b>								
Formaldehyde	1.72E-10	1.48E-01	2.71E-09	no	3.26E-02	1.23E+03	2.65E-05	no
Acetaldehyde	1.26E-10	8.73E-01	3.37E-10	no	2.39E-02	1.80E+04	1.33E-06	no
Acetone	9.33E-11	3.65E+02	2.56E-13	no	3.04E-02	2.37E+06	1.28E-08	no
Propionaldehyde	NA	NV	na	NA	7.50E+04		na	
Crotonaldehyde	NA	3.54E-03	na	NA	5.72E+03		na	
Butyraldehyde	NA	NV	na	NA	7.38E+04		na	
Benzaldehyde	NA	3.65E+02	na	NA	1.50E+04		na	
Isovaleraldehyde	NA	NV	na	NA	NA		na	
Valeraldehyde	NA	NV	na	NA	NA		na	
o,m,p-Toluinaldehyde	NA	NV	na	NA	NA		na	
Haxaldehyde	NA	NV	na	NA	NA		na	
2,5-Dimethylbenzaldehyde	NA	NV	na	NA	NA		na	
<b>VOCs</b>								
Propene	3.94E-10	NV	na	3.21E-02	NA		na	
Dichlorodifluoromethane	NA	2.09E+02	na	NA	1.48E+07		na	
Chlorodifluoromethane	NA	5.11E+04	na	NA	4.41E+06		na	
Freon 114	NA	NV	na	NA	2.10E+07		na	
Chloromethane	1.09E-12	1.07E+00	2.39E-12	no	8.30E-04	2.06E+05	4.03E-09	no
Vinyl Chloride	NA	2.20E-02	na	NA	1.28E+04		na	
1,3-Butadiene	2.06E-11	3.74E-03	1.29E-08	no	3.92E-03	2.20E+04	1.78E-07	no
Bromomethane	NA	5.21E+00	na	NA	5.82E+04		na	
Chloroethane	NA	2.32E+00	na	NA	2.64E+06		na	
Dichlorofluoromethane	NA	2.09E+02	na	NA	1.48E+07		na	

M781 40mm TPT fired from the M203 (DODIC B519)						
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL > 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute</sub> /ATV > 1?
Trichlorofluoromethane	1.01E-12	7.30E+02	1.39E-15	no	3.30E-04	2.81E+06
Acrolein	7.35E-10	2.09E-02	3.53E-08	no	5.99E-02	2.30E+02
1,1-Dichloroethene	NA	5.21E+02		na	NA	7.92E+04
Freon 113	NA	3.13E+04		na	NA	9.58E+06
Methyl Iodide	NA	NV		na	NA	1.18E-10
Carbon Disulfide	6.01E-10	7.30E+02	8.23E-13	no	1.96E-01	3.11E+04
Acetonitrile	2.71E-10	6.20E+01	4.37E-12	no	8.84E-02	1.01E+05
3-Chloropropene	NA	1.04E+00		na	NA	8.77E-07
Methylene Chloride	6.29E-10	4.09E+00	3.59E-10	no	1.19E-01	6.29E-06
tert-Butyl Alcohol	NA	NV		na	NA	6.96E+05
Acrylonitrile	1.82E-10	2.83E-02	1.50E-08	no	3.46E-02	4.55E+05
trans-1,2-Dichloroethene	NA	7.30E+01		na	NA	2.17E+04
Methyl t-Butyl Ether	NA	3.13E+03		na	NA	1.72E-07
Hexane	6.83E-10	2.09E+02	3.27E-12	no	2.22E-01	5.28E+05
1,1-Dichloroethane	NA	5.21E+02		na	NA	4.21E-07
Vinyl Acetate	NA	2.09E+02		na	NA	1.21E+06
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	1.92E+04
2-Butanone	2.41E-11	1.04E+03	2.31E-14	no	7.84E-03	7.92E+05
Ethyl Acetate	NA	3.29E+03		na	NA	8.85E+05
Methyl Acrylate	NA	1.10E+02		na	NA	1.44E+06
Chloroform	NA	8.35E-02		na	NA	9.76E+03
1,1,1-Trichloroethane	5.44E-10	1.04E+03	5.21E-13	no	4.43E-02	1.94E+06
Carbon Tetrachloride	8.78E-12	1.28E-01	1.60E-10	no	1.67E-03	1.28E+05
1,2-Dichloroethane	1.89E-11	7.39E-02	5.96E-10	no	1.43E-02	8.08E+03
Benzene	1.30E-09	2.49E-01	1.22E-08	no	2.47E-01	1.77E-06
Isooctane (2,2,4-trimethylpentane)	NA	NV		na	NA	1.56E+05
Heptane	NA	NV		na	NA	3.50E+05
Trichloroethane	NA	1.04E+03		na	NA	1.80E+06
Ethyl Acrylate	NA	1.40E-01		na	NA	1.94E+06
1,2-Dichloropropane	NA	9.89E-02		na	NA	6.14E+04

Table D-3: Comparison of Air Concentrations With Health-Based Values for the M781

M781 40mm TPT fired from the M203 (DODIC B519)							
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute</sub> / ATV > 1?
Methyl Methacrylate	NA	7.30E+02		na	NA	4.09E+05	na
Dibromomethane	NA	3.65E+01		na	NA	2.50E+05	na
1,4-Dioxane	NA	6.11E-01		na	NA	9.00E+04	na
Bromodichloromethane	NA	1.08E-01		na	NA	4.00E+03	na
4-Methyl-2-Pentanone	NA	8.34E+01		na	NA	3.07E+05	na
Toluene	3.86E-10	4.02E+02	9.62E-13	no	3.14E-02	1.88E+05	1.68E-07
Octane	6.36E-12	NV		na	5.18E-04	NA	na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA	na
Ethyl Methacrylate	NA	3.29E+02		na	NA	NA	na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05	na
Tetrachloroethene	NA	3.31E+00		na	NA	6.78E+05	na
2-Hexanone	NA	5.11E+00		na	NA	4.09E+04	na
Dibromochloromethane	NA	8.00E-02		na	NA	6.00E+03	na
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05	na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05	na
1,1,1,2-Tetrachloroethane	NA	2.60E-01		na	NA	5.15E+04	na
Ethylbenzene	9.96E-11	1.06E+03	9.41E-14	no	3.24E-02	5.43E+05	5.98E-08
m&p-Xylene	3.46E-10	7.30E+02	4.74E-13	no	1.13E-01	6.51E+05	1.73E-07
<i>o</i> -Xylene	2.52E-10	7.30E+02	3.45E-13	no	8.20E-02	6.51E+05	1.26E-07
Styrene	1.08E-09	1.06E+03	1.02E-12	no	8.78E-02	2.13E+05	4.12E-07
Bromoform	NA	1.75E+00		na	NA	6.20E+03	na
Cumene	1.69E-11	4.02E+02	4.21E-14	no	5.51E-03	2.46E+05	2.25E-08
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04	na
1,2,3-Trichloropropane	NA	9.61E-04		na	NA	6.03E+04	na
Bromobenzene	NA	1.04E+01		na	NA	4.82E+04	na
4-Ethyltoluene	1.29E-10	NV		na	4.20E-02	1.25E+05	3.36E-07
1,3,5-Trimethylbenzene	7.27E-11	6.21E+00	1.17E-11	no	2.37E-02	3.68E+05	6.43E-08
Alpha Methyl Styrene	NA	2.56E+02		na	NA	NA	na
1,2,4-Trimethylbenzene	2.42E-10	6.21E+00	3.90E-11	no	7.88E-02	1.80E+05	4.38E-07
1,3-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04	na

..... values for the M781

M781 40mm TPT fired from the M203 (DODIC B519)						
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )
1,4-Dichlorobenzene	NA	3.06E-01	na	NA	6.61E+05	na
Benzyl Chloride	NA	3.96E-02	na	NA	5.20E+03	na
1,2-Dichlorobenzene	NA	2.09E+02	na	NA	3.01E+05	na
Hexachlorethane	NA	4.80E-01	na	NA	2.90E+04	na
1,2,4-Trichlorobenzene	NA	2.08E+02	na	NA	3.71E+04	na
Hexachlorobutadiene	NA	8.73E-02	na	NA	3.21E+04	na
<b>Hydrocarbons</b>						
Methane	1.76E-08	NV	na	5.72E+00	3.30E+06	1.73E-06
Ethylene	7.80E-09	NV	na	2.54E+00	4.60E+05	5.52E-06
Acetylene	6.37E-09	NV	na	5.19E-01	NA	na
Ethane	3.48E-10	NV	na	2.83E-02	NA	na
Propane	NA	NV	na	NA	3.78E+06	na
Propyne (methyl acetylene)	3.09E-10	NV	na	1.01E-01	2.79E+06	3.61E-08
Isobutane	NA	NV	na	NA	9.52E+05	na
1-Butene/isobutylene (115-11-7)	3.56E-10	NV	na	1.16E-01	6.87E+06	1.69E-08
Butane	NA	NV	na	NA	5.71E+06	na
1-Butyne/cis-Butene	NA	NV	na	NA	NA	na
trans-Butene	NA	NV	na	NA	NA	na
2-Butyne (crotonylene)	NA	NV	na	NA	NA	na
n-Pentane	NA	NV	na	NA	NA	na
<b>C Tentatively Identified Compounds (TICs)</b>						
Propyne /-Propyne	1.92E-10	NV	na	6.24E-02	2.79E+06	2.24E-08
1-Chloro-1,1-difluoroethane	NA	5.22E+04	na	NA	4.11E+07	na
2-Methyl-1-propene (Isobutene)	1.43E-10	NV	na	4.67E-02	6.87E+06	6.80E-09
Acetaldehyde	4.47E-11	8.73E-01	1.20E-10	no	8.50E-03	1.80E+04
1-Buten-3-yne (vinyl acetylene)	2.89E-11	NV	na	2.35E-03	NA	4.72E-07
Ethylcyclopropane	NA	NV	na	NA	NA	na
Ethanol	NA	NV	na	NA	5.64E+06	na
Furan	7.55E-11	3.65E+00	2.07E-11	no	2.46E-02	1.47E-04
1-Hexene	NA	NV	na	NA	NA	na

Table D-3: Comparison of Air Concentrations With Health-Based Values for the M781

M781 40mm TPT fired from the M203 (DODIC B519)						
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic / HBSL</sub>	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )
Thiirane (ethylene sulfide)	1.60E-10	NV		na	1.31E-02	NA
Thiophene	7.46E-11	NV		na	6.08E-03	NA
2,2,4-Trimethyl-1-pentene	NA	NV		na	NA	NA
Undecane	7.01E-10	NV		na	2.28E-01	6.39E+03
3-Methyl-undecane (dodecane)	2.28E-10	NV		na	7.43E-02	3.48E+03
Dodecane	7.60E-10	NV		na	2.48E-01	7.11E-05
2,6-Dimethyl-undecane	2.88E-10	NV		na	2.34E-02	NA
<b>SVOCs</b>						
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04
phenol	NA	2.19E+03		na	NA	3.85E+04
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03
1,3-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04
2-methylphenol	NA	1.83E+02		na	NA	NA
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04
n-nitroso-di-n-propylamine	NA	9.67E-04		na	NA	2.00E+02
4-methylphenol	NA	1.83E+02		na	NA	NA
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04
isophorone	NA	7.08E+00		na	NA	2.83E+04
2-nitrophenol	NA	NV		na	NA	NA
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04
Benzoic Acid	3.04E-10	1.46E+04	2.08E-14	no	9.91E-02	1.25E+04
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04

Table 1. Estimated values for the M781

M781 40mm TPT fired from the M203 (DODIC B519)

M781 40mm TPT fired from the M203 (DODIC B519)						
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HB <sub>SL</sub>	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	3.00E+04
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02
2-nitroaniline	NA	2.09E-01		na	NA	NA
dimethylphthalate	NA	3.65E+04		na	NA	NA
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02
3-nitroaniline	NA	NV		na	NA	NA
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03
dibenzofuran	NA	1.46E+01		na	NA	NA
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04
4-chlorophenyl-phenylether	NA	NV		na	NA	NA
diethylphthalate	1.73E-10	2.92E+03	5.91E-14	no	5.62E-02	1.50E+04
4-nitroaniline	NA	NV		na	NA	9.00E+03
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA
4-bromophenyl-phenylether	NA	NV		na	NA	NA
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01
pentachlorophenol	NA	5.60E-02		na	NA	5.00E+05
di-n-butylphthalate	1.39E-10	3.66E+02	3.81E-13	no	4.53E-02	1.50E+04
butylbenzylphthalate	NA	7.30E+02		na	NA	3.02E-06
3,3-dichlorobenzidine	NA	1.50E-02		na	NA	NA
bis(2-ethylhexyl)phthalate	4.96E-10	4.80E-01	2.41E-09	no	3.77E-01	1.00E+04
di-n-octylphthalate	NA	7.30E+01		na	NA	3.77E-05
<b>SVOC Tentatively Identified Compounds (TICs)</b>				no	1.50E+05	no
Acetophenone	1.92E-10	2.10E-02	9.12E-09	no	6.24E-02	3.00E+04
						2.08E-06
						no

Table D-3: Comparison of Air Concentrations With Health-Based Values for the M781

M781 40mm TPT fired from the M203 (DODIC B519)								
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic/</sub> HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute / ATv</sub>	> 1?
Phenol (to be added to Form I)	5.53E-11	2.19E+03	2.53E-14	no	1.80E-02	3.85E+04	4.68E-07	no
Benzonitrile	8.49E-11	NV		na	2.77E-02	1.50E+04	1.84E-06	no
Undecane	2.30E-10	NV		na	7.50E-02	6.39E+03	1.17E-05	no
Dodecane	3.01E-10	NV		na	9.82E-02	3.48E+03	2.82E-05	no
Hexyl-cyclohexane	1.54E-10	NV		na	1.25E-02	NA	na	
Dodecamethylcyclohexiloxane	1.13E-10	NV		na	9.19E-03	NA	na	
Dodecanoic Acid (Lauric Acid)	8.87E-11	NV		na	7.23E-03	NA	na	
Hexadecanoic Acid (Palmitic Acid)	1.05E-10	NV		na	3.42E-02	7.50E+02	4.56E-05	no
Octadecanoic Acid (Stearic Acid)	NA	NV		na	NA	3.50E+04	na	
bis(2-ethylhexyl) Decanedioic Acid	NA	NV		na	NA	NA	na	
<b>TO-13 (PAHs)</b>								
naphthalene	5.38E-11	3.13E+00	1.72E-11	no	1.75E-02	7.86E+04	2.23E-07	no
acenaphthylene	9.36E-12	NV		na	3.05E-03	2.00E+02	1.52E-05	no
acenaphthene	5.22E-13	2.19E+02	2.38E-15	no	1.70E-04	1.25E+03	1.36E-07	no
fluorene	1.21E-12	1.46E+02	8.29E-15	no	3.94E-04	7.50E+04	5.26E-09	no
phenanthrene	1.47E-12	NV		na	4.79E-04	2.00E+03	2.39E-07	no
anthracene	2.63E-13	1.10E+03	2.41E-16	no	8.58E-05	6.00E+03	1.43E-08	no
fluoranthene	4.69E-13	1.46E+02	3.21E-15	no	1.53E-04	3.00E+01	5.09E-06	no
pyrene	4.87E-13	1.10E+02	4.45E-15	no	1.59E-04	1.50E+04	1.06E-08	no
benzo(a)anthracene	4.02E-14	2.17E-02	4.33E-12	no	3.06E-05	6.00E+02	5.10E-08	no
chrysene	7.89E-14	2.17E+00	8.49E-14	no	6.00E-05	2.00E+02	3.00E-07	no
benzo(b)fluoranthene	2.14E-13	2.17E-02	2.31E-11	no	4.07E-05	NA	na	
benzo(k)fluoranthene	1.42E-13	2.17E-01	1.53E-12	no	2.71E-05	NA	na	
benzo(a)pyrene	1.55E-13	2.17E-03	1.67E-10	no	1.18E-04	7.50E+03	1.57E-08	no
indeno(1,2,3-cd)pyrene	2.23E-13	2.17E-02	2.40E-11	no	4.23E-05	NA	na	
dibenz(a,h)anthracene	1.10E-14	2.17E-03	1.19E-11	no	8.38E-06	3.00E+04	2.79E-10	no
benzo(g,h,i)perylene	9.75E-13	NV		na	3.18E-04	3.00E+04	1.06E-08	no
Dioxins/Furans	NA	4.48E-08		na	NA	3.50E+00	na	
2378-Tetrachlorodibenzo-p-dioxin	NA	NV		na	NA	2.50E+00	na	
12378-Pentachlorodibenzo-p-dioxin	NA	NV		na	NA	NA	na	

M781 40mm TPT fired from the M203 (DODIC B519)							
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute</sub> / ATV > 1?
123478-Hexachlorodibenzo-p-dioxin	1.13E-17	NV		na	9.17E-10	NA	na
123678-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	1.50E+01	na
123789-Hexachlorodibenzo-p-dioxin	NA	1.48E-06		na	NA	NA	na
1234678-Heptachlorodibenzo-p-dioxin	1.06E-16	NV		na	8.62E-09	NA	na
OCDD	7.66E-16	NV		na	2.50E-07	1.50E+02	1.66E-09
2378-Tetrachlorodibenzo-p-furan	NA	NV		na	NA	2.00E+00	no
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	NA	na
23478-Pentachlorodibenzo-o-furan	NA	NV		na	NA	7.50E-02	na
123478-Hexachlorodibenzo-p-furan	NA	NV		na	NA	7.50E+00	na
123678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	2.50E+00	na
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA	na
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA	na
1234678-Heptachlorodibenzo-p-furan	NA	NV		na	NA	1.50E+00	na
1234789-Heptachlorodibenzo-p-furan	NA	NV		na	NA	NA	na
OCDF	NA	NV		na	NA	NA	na
<b>Energetics</b>							
Nitrobenzene	NA	2.09E+00		na	NA	1.51E+04	na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA	na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA	na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04	na
Nitroglycerine	NA	4.80E-01		na	NA	NA	na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03	na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04	na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04	na
RDX	NA	6.11E-02		na	NA	NA	na
4-Amino-2,6-Dinitrotoluene	NA	NV		na	NA	NA	na
2-Amino-2,6-Dinitrotoluene	NA	NV		na	NA	1.50E+04	na
Tetryl	NA	3.65E+01		na	NA	NA	na
HMX	NA	1.83E+02		na	NA	NA	na
Pentaerythritoltetranitrate	NA	NV		na	NA	5.00E+01	na

**Table D-3: Comparison of Air Concentrations With Health-Based Values for the M781**

M781 40mm TPT fired from the M1203 (DODIC B519)								
Compound	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	Health-Based Screening Level ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> / HBSL	> 1?	C <sub>acute</sub> ( $\mu\text{g}/\text{m}^3$ )	Acute Toxicity Value ( $\mu\text{g}/\text{m}^3$ )	C <sub>acute</sub> / ATV	> 1?
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04		na

Footnotes:

NA: Not applicable because compound was not detected.

na: Not available because health-based screening value is not available or not applicable if compound was not detected.

NV: No value available.

C<sub>chronic</sub>: Chronic time-averaged concentration

HBSL: Chronic health-based screening level

C<sub>acute</sub>: acute concentration

ATV: Acute toxicity value

..... w. r. Comparison of Air Concentrations With Health-Based Values for the M781: Total Petroleum Hydrocarbons

Compound (a)	M781 40mm TPT fired from the M203 (DODIC B519)		
	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )
	Aliphatic:C<=8	Aliphatic:C>8	Aromatic:C<=8
Hexane	6.83E-10	NA	NA
Benzene	NA	NA	3.04E-09
Toluene	NA	NA	3.86E-10
Octane	6.36E-12	NA	NA
Ethylbenzene	NA	NA	NA
m&p-Xylene	NA	NA	9.96E-11
o-Xylene	NA	NA	3.46E-10
Styrene	NA	NA	2.52E-10
Cumene	NA	NA	NA
4-Ethyltoluene	NA	NA	NA
1,3,5-Trimethylbenzene	NA	NA	NA
1,2,4-Trimethylbenzene	NA	NA	NA
Propyne (methyl acetylene)	3.09E-10	NA	NA
1-Butene/isobutylene (115:11:7)	3.56E-10	NA	NA
Propyne /1-Propyne	1.92E-10	NA	NA
Undecane	NA	7.01E-10	NA
3-Methyl-undecane (dodecane)	NA	2.28E-10	NA
Dodecane	NA	7.60E-10	NA
2,6-Dimethyl-undecane	NA	2.88E-10	NA
Undecane	NA	2.30E-10	NA
Dodecane	NA	3.07E-10	NA
Hexyl-cyclohexane	NA	1.54E-10	NA
naphthalene	NA	NA	NA
acenaphthylene	NA	NA	5.38E-11
acenaphthene	NA	NA	9.35E-12
fluorene	NA	NA	5.22E-13
phenanthrene	NA	NA	1.21E-12
anthracene	NA	NA	1.47E-12
		NA	2.63E-13

Table D-4: Comparison of Air Concentrations With Health-Based Values for the M781: Total Petroleum Hydrocarbons

M781 40mm TPT fired from the M203 (DODIC B519)					
Compound (a)	C <sub>chronic</sub> ( $\mu\text{g}/\text{m}^3$ )				
	<i>Aliphatic:C&lt;=8</i>	<i>Aliphatic:C&gt;8</i>		<i>Aromatic:C&lt;=8</i>	<i>Aromatic:C&gt;8</i>
fluoranthene	NA	NA	NA	NA	4.69E-13
Total ( $\mu\text{g}/\text{m}^3$ )	1.55E-09	2.66E-09	4.12E-09	1.61E-09	
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02	
C <sub>chronic</sub> /HBSL	8.05E-14	2.55E-12	9.88E-12	7.70E-12	
>1?	no	no	no	no	no

Footnotes:

>1? = Is the ratio greater than one?

NA = Not Applicable because compound was not detected

C<sub>chronic</sub> = chronic averaged air Concentration

HBSL = Health-Based Screening Level

## **APPENDIX E**

**FACT SHEETS SUBMITTED TO THE  
U.S. ARMY ENVIRONMENTAL CENTER**

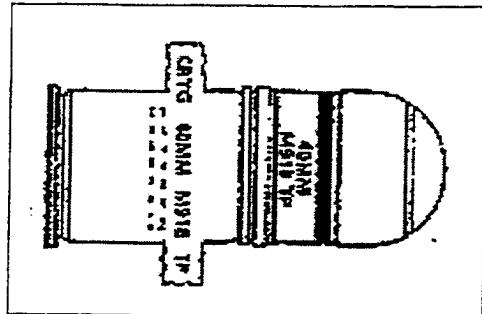
# **U.S. Army Environmental Center**

## **Training Munitions Fact Sheet**

### **M918 40-mm Practice Cartridge**

*Department of Defense Identification Code: B584*

***Breathing air emissions from the M918 40-mm practice cartridge will not impact the health of residents who live near Army training facilities.***



To be fully prepared to protect our country, U.S. soldiers must train with many different weapons and munitions, including the M918 40-mm practice cartridge. This training is important because it helps prepare our soldiers for a variety of combat situations. While the Army recognizes the value of such comprehensive training on our installations, we also work hard to ensure the safety and health of surrounding communities.

### **WILL BREATHING AIR EMISSIONS FROM THE M918 40-MM PRACTICE CARTRIDGE AFFECT MY HEALTH?**

To answer this question, the U.S. Army tested the air emissions that are released when the M918 is fired. The information gathered during these tests was then analyzed to determine if there would be a potential for health effects from inhalation to residents who live near training areas. Study results, generated using conservative methods, showed that offsite residents breathing air as close as 100 meters (328 feet or about the length of a football field) from the firing location are safe from these emissions. At most locations, training areas are at least 1,000 meters (over half a mile) away from populated areas and the distance to firing locations may be even farther.

### **HOW WAS THE STUDY CONDUCTED?**

To gather data for this study, the M918 was fired from the Mark 19 machine gun in a test chamber. The air in the chamber was then tested to identify the types and amounts of substances released. About 300 different substances were looked for during this part of the study.

This information was then used in an U.S. Environmental Protection Agency (USEPA) approved air model (a computer program that allows estimation of air concentrations) to determine the amount of each substance to which someone living near a training site might be exposed. Downwind concentrations were

estimated based on a typical use scenario for the M918 during training exercises. Since this study did not look at any one specific training area, the assumptions used in the model would, in most cases, predict higher downwind air concentrations than those expected at an actual training site.

These estimated air concentrations were then compared to screening levels established by the USEPA and other federal agencies. If the air concentrations are less than these screening levels, they are considered safe for the general population, including sensitive people such as the sick, elderly, and children.

### **WHAT ARE THE STUDY LIMITATIONS?**

Many steps were taken to ensure that the results of this study are protective of residents who live near training facilities. However, as with any study, this study has limitations. For example, the study does not consider exposure to other types of munitions that could also be used during the same training event. Due to these limitations, conservative model conditions were used to ensure the protection of public health from breathing M918 air emissions.

### **WHAT EXACTLY IS THE M918 40-MM PRACTICE CARTRIDGE?**

The M918 is a practice round used only in training. Multiple cartridges are linked together and fired at targets of varying distance. The M918 mimics the appearance and behavior of the M430 cartridge used in combat. Each M918 cartridge consists of a steel body enclosed in an aluminum case. The propelling charge is made primarily of nitrocellulose and nitroglycerine. Nitrocellulose is the primary ingredient in smokeless propellant (for both military and commercial use) and is also used in the production of lacquers and artificial leathers.

Nitroglycerine is a component in dynamite and is used for military and industrial purposes such as mining and demolition. Each M918 cartridge is about the length of a soda can and can be identified by its blue and brown color with black markings.

### **WHERE CAN I GET MORE INFORMATION?**

For more information on the M918 or other military munitions, please call the Army Environmental Hotline at 1-800-USA-3845, visit our Web site at [www.aec.army.mil](http://www.aec.army.mil), or e-mail [t2hotline@aec.apgea.army.mil](mailto:t2hotline@aec.apgea.army.mil).

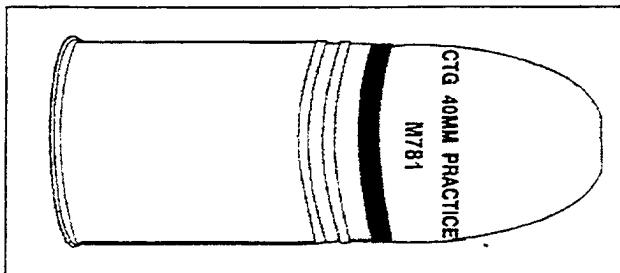
# **U.S. Army Environmental Center**

## **Training Munitions Fact Sheet**

### **M781 40-mm Practice Cartridge**

*Department of Defense Identification Code: B519*

**Breathing air emissions from the M781 40-mm practice cartridge will not impact the health of residents who live near Army training facilities.**



To be fully prepared to protect our country, U.S. soldiers must train with many different weapons and munitions, including the M781 40-mm practice cartridge. This training is important because it helps prepare our soldiers for a variety of combat situations. While the Army recognizes the value of such comprehensive training on our installations, we also work hard to ensure the safety and health of surrounding communities.

### **WILL BREATHING AIR EMISSIONS FROM THE M781 40-MM PRACTICE CARTRIDGE AFFECT MY HEALTH?**

To answer this question, the U.S. Army tested the air emissions that are released when the M781 is fired. The information gathered during these tests was then analyzed to determine if there would be a potential for health effects from inhalation to residents who live near training areas. Study results, generated using conservative methods, showed that offsite residents breathing air as close as 100 meters (328 feet or about the length of a football field) from the firing location are safe from these emissions. At most locations, training areas are at least 1,000 meters (over half a mile) away from populated areas and the distance to firing locations may be even farther.

### **HOW WAS THE STUDY CONDUCTED?**

To gather data for this study, the M781 was fired from the M203 40-mm Grenade Launcher in a test chamber. The air in the chamber was then tested to identify the types and amounts of substances released. About 300 different substances were looked for during this part of the study.

This information was then used in an U.S. Environmental Protection Agency (USEPA) approved air model (a computer program that allows estimation of air concentrations) to determine the amount of each substance to which someone living near a training site might be exposed. Downwind concentrations were estimated based on a typical use scenario for the M781 during training exercises.

Since this study did not look at any one specific training area, the assumptions used in the model would, in most cases, predict higher downwind air concentrations than those expected at an actual training site.

These estimated air concentrations were then compared to screening levels established by the USEPA and other federal agencies. If the air concentrations are less than these screening levels, they are considered safe for the general population, including sensitive people such as the sick, elderly, and children.

### **WHAT ARE THE STUDY LIMITATIONS?**

Many steps were taken to ensure that the results of this study are protective of residents who live near training facilities. However, as with any study, this study has limitations. For example, the study does not consider exposure to other types of munitions that could also be used during the same training event.. Due to these limitations, conservative model conditions were used to ensure the protection of public health from breathing M781 air emissions.

### **WHAT EXACTLY IS THE M781 40-MM PRACTICE CARTRIDGE?**

The M781 is a practice round used to train soldiers operation of the M203. When launched, the M781 can reach a maximum distance of up to 400 meters (0.25 miles). Upon impact, the M781 releases a bright yellow-orange smoke that can be used to determine the distance from the target. The M781 consists of a metal projectile that is attached to a plastic cartridge case. The cartridge is filled with a yellow-orange dye that produces smoke when the M781 hits a target. Each M781 cartridge is about the length of a soda can and can be identified by its blue casing with white markings.

### **WHERE CAN I GET MORE INFORMATION?**

For more information on the M781 or other military munitions, please call the Army Environmental Hotline at 1-800-USA-3845, visit our Web site at [www.aec.army.mil](http://www.aec.army.mil), or e-mail [t2hotline@aec.apgea.army.mil](mailto:t2hotline@aec.apgea.army.mil).